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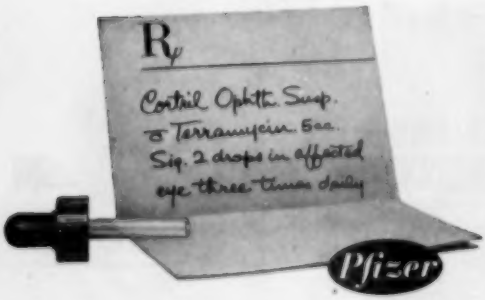

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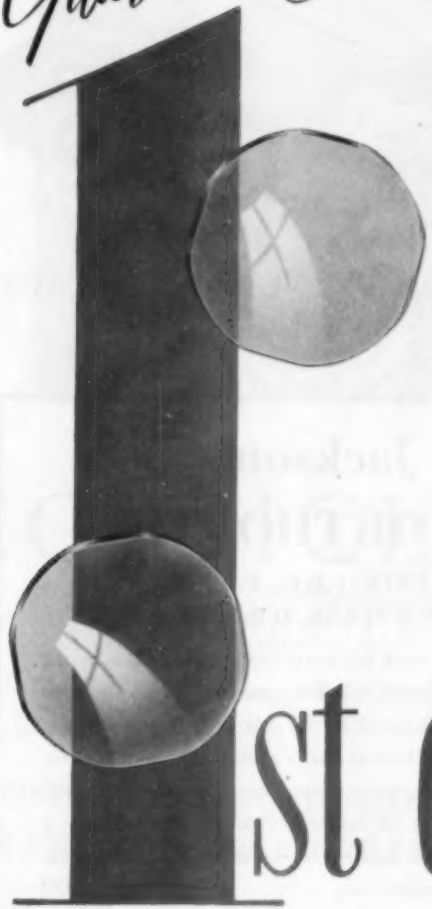

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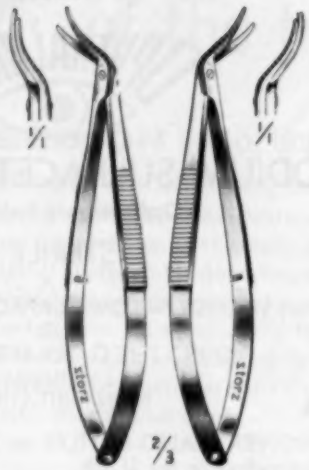

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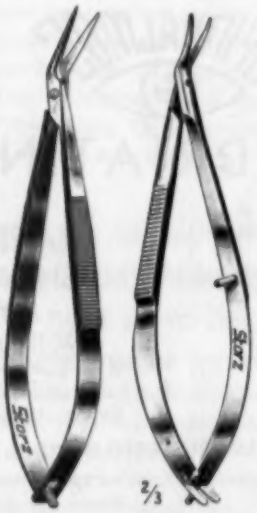

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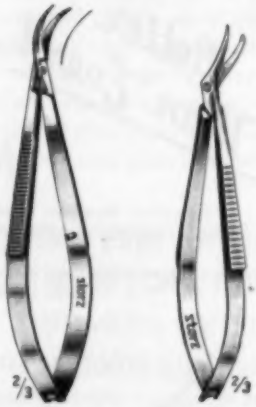

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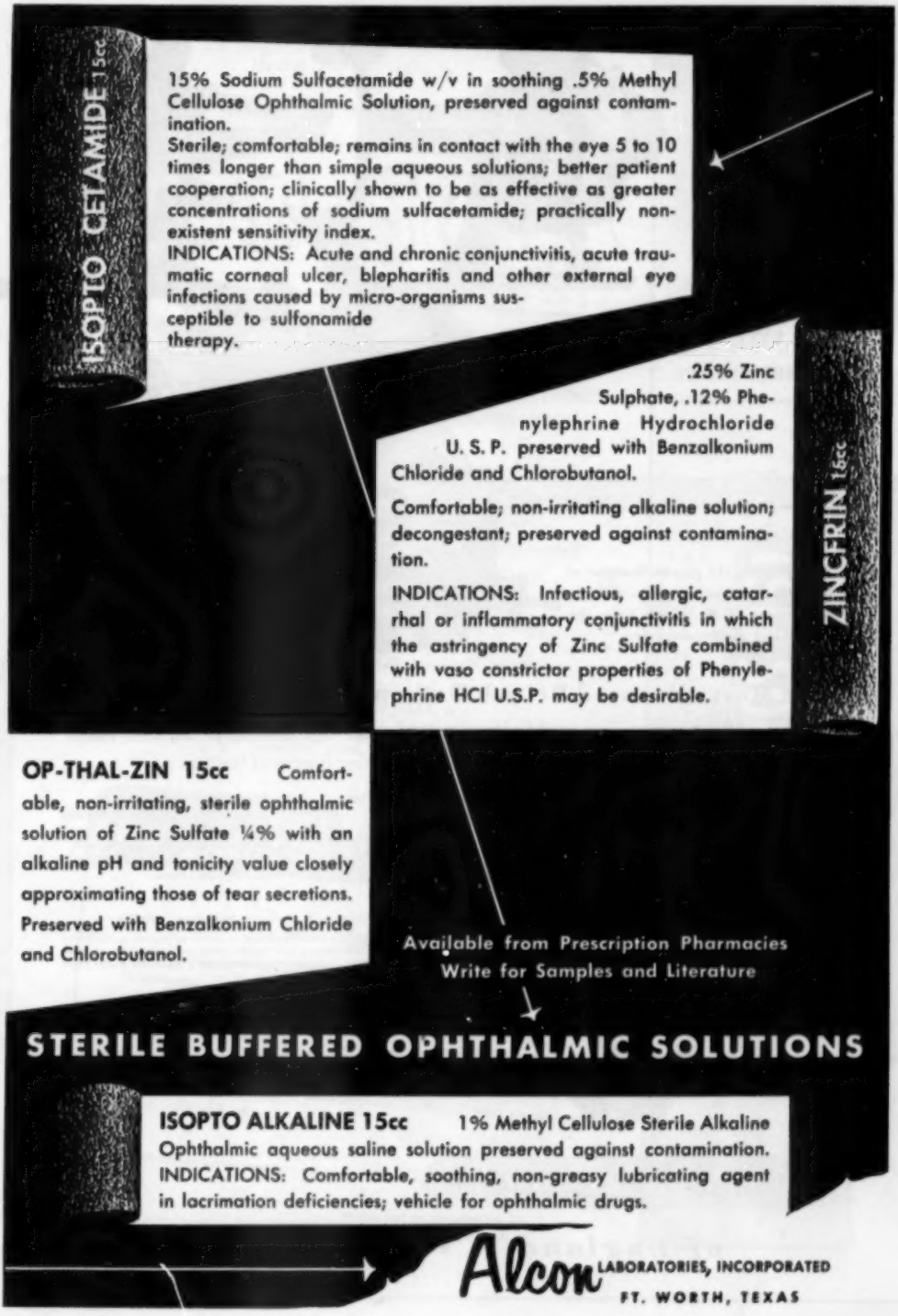
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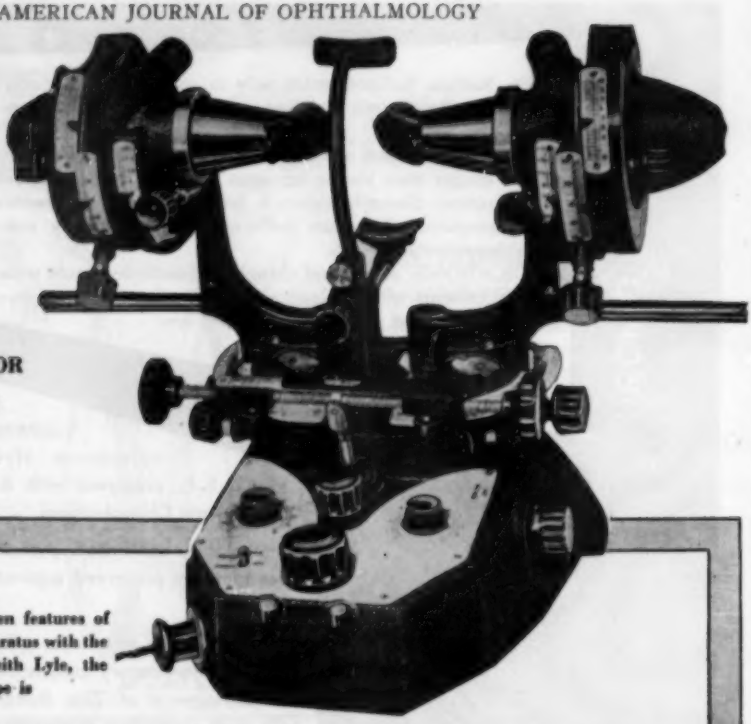

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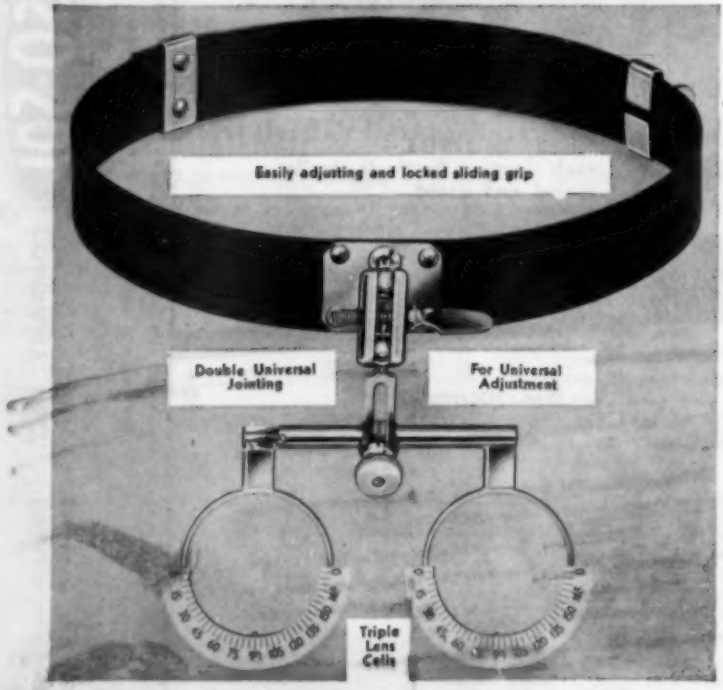

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1. Pritikin, R. I.: J. Internat. Coll. Surgeons 17: 234, 1952.
2. _____, and Duchon, M. L.: Mil. Surgeon 109: 706, 1951.
3. _____, _____, and Farmer, H. S.: Mil. Surgeon 108: 309, 1951.
4. Brennan, J. W.: Am. J. Ophth. 35: 1343, 1952.

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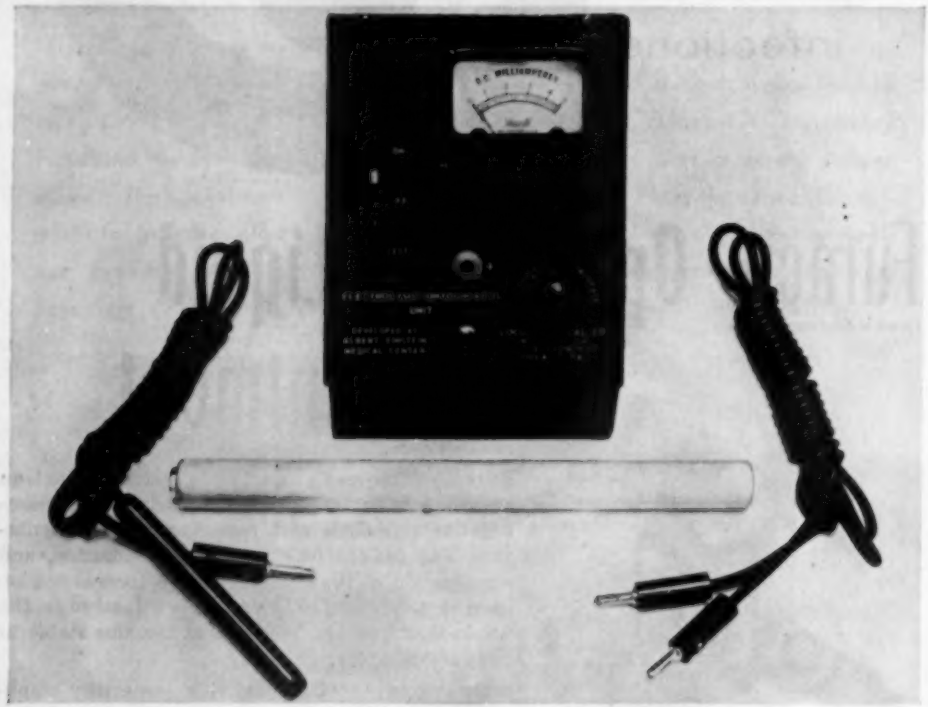

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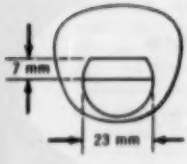

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FIG. 2. Arrangement same as Fig. 1, but testing button employed in Nu-Line 7 CV. Note reduction in light around slot and low meter reading.

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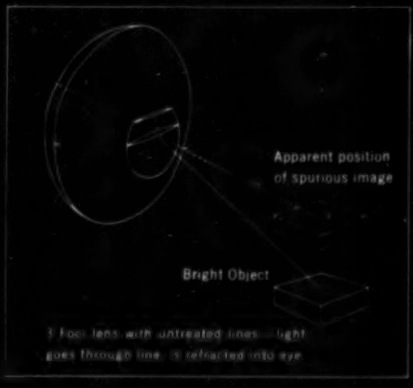
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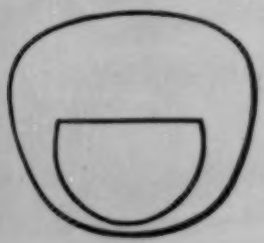

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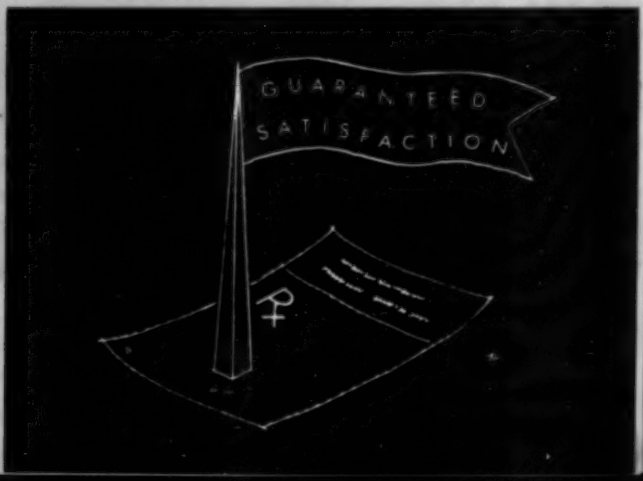

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ABSTRACTS

General pathology, bacteriology, immunology; Vegetative physiology, biochemistry, pharmacology, toxicology; Physiologic optics, refraction, color vision; Diagnosis and therapy; Ocular motility; Conjunctiva, cornea, sclera; Uvea, sympathetic disease, aqueous; Glaucoma and ocular tension; Crystalline lens; Retina and vitreous; Optic nerve and chiasm; Neuro-ophthalmology; Eyeball, orbit, sinuses; Eyelids, lacrimal apparatus; Tumors; Injuries; Systemic disease and parasites; Congenital deformities, heredity; Hygiene, sociology, education, and history 601

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OPTIC NEURITIS IN RELATION TO DEMYELINATING DISEASES*

A CLINICAL STUDY

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When studying the hospital records of patients with diseases of the optic nerve commonly grouped under neuritis, we were struck by the fact that the greatest number of cases were of retrobulbar neuritis and that most of these patients suffered from multiple sclerosis. Among 72 cases of optic neuritis, 83.3 percent were retrobulbar, and in 69.4 percent of the patients the optic-nerve involvement was due to multiple sclerosis.

This is in sharp contrast to experience in office ophthalmology where the etiology is usually unknown at the time the patient is suffering from optic neuritis. Among 42 cases from private practice,† only 16.6 percent showed other signs of multiple sclerosis. It should be emphasized that it was impossible to rule out multiple sclerosis in most of the remaining cases.

Similar statistics were obtained by Benedict[1] and Carroll.[2] In the period from 1920 to 1940 at the Mayo Clinc, there were 90 patients in whom multiple sclerosis was suspected among 400 cases of retrobulbar neuritis. Carroll reported multiple sclerosis in 19 percent of 240 cases of retrobulbar neuritis, and probable multiple sclerosis in 10 percent more.

Some of the discrepancy in the statistics from a chronic disease hospital such as Montefiore and those from a hospital where acute diseases are treated or from private practice occurs because the ophthalmologist in private practice is more likely to see the initial attack of optic neuritis months or years before multiple sclerosis is fully developed and diagnosed.

Once the diagnosis has been made, and especially if the patient becomes bedridden, the neurologist does not, as a rule, refer the patient to the ophthalmologist; but the latter will examine such patients in a hospital for chronic diseases which has a large neurologic service. For these reasons we believe that the true percentage of cases in which optic neuritis is due to multiple sclerosis lies closer to the 69.4 percent in a chronic disease hospital than the 16.6 percent of private practice. To substantiate this premise one should note that Gartner[3] and Lisch[4] report optic-nerve involvement in 100 percent of random cases of multiple sclerosis which were examined at autopsy.

OPTIC-NERVE LESIONS IN MULTIPLE SCLEROSIS

Multiple sclerosis is a disease which lasts for a varying period of time, anywhere from a few weeks to 30 years, and the patient is subject to remissions and exacerbations. The successive remissions become less complete because the residual damage is cumulative.

* From the Department of Ophthalmology, Montefiore Hospital, New York. Presented before the New York Society for Clinical Ophthalmology, January, 1953.

† The records of many of these patients were obtained through the courtesy of Dr. Max Chamlin.

Optic neuritis behaves in a somewhat similar manner. When an acute attack occurs in the later stages of the disease, it is more likely to cause a greater amount of permanent visual disturbance than it would in the earlier stages. It is probably superimposed on the residual damage of previous attacks which may have remained undetected due to the lack of involvement of the fixation area. When optic neuritis is the first symptom of multiple sclerosis, almost complete recovery is possible; however, this occurs much less frequently than the literature would lead us to believe. When the optic-nerve lesions are detected late in the disease, the chances for complete recovery are smaller because of the cumulative damage.

Out of the 72 cases of optic neuritis at Montefiore Hospital and the 42 cases from private practice, satisfactory clinical evidence of multiple sclerosis was present in 50 hospital cases and in seven private ones. Of these 57 clinical cases, 34 were examined at autopsy and the diagnosis of multiple sclerosis was confirmed.

Onset of visual disturbance

Visual disturbance was the initial symptom in 17 of the cases (table 1). This is in line with Benedict's figures. He reported visual disturbance as the initial lesion in 15 percent of 500 cases of definitely proven multiple sclerosis. In a study of 100 cases of multiple sclerosis by Yaskin, Spaeth, and Vernlund,[5] 31 cases showed retrobulbar neuritis; 35 percent of these patients had involvement of the optic nerve as the initial lesion. Wybar,[6] on the other hand, reported optic neuritis as an initial lesion in 76 percent of cases.

TABLE 1

History of visual symptoms

	Cases
Initial attack: visual disturbance, no other symptoms of multiple sclerosis at this time	17
Visual disturbance after onset of multiple sclerosis	19
Probable acute attack, after onset of other symptoms of multiple sclerosis	3
Progressive loss of vision	7
Progressive loss of vision and acute attack	1
No history of loss of vision	10
Total	57

In 19 patients, the first attack of optic neuritis occurred after a diagnosis of multiple sclerosis had been established by other means. The visual disturbance occurred from one week after the onset of multiple sclerosis in two cases to 13 years later in one case. In 13 cases the initial involvement of the optic nerve happened within four years after the onset of the disease. In one case it occurred in five years, in two cases in six years, and in three cases in nine years after the appearance of other signs of multiple sclerosis. Three patients probably had acute episodes at some time during the course of their disease, but they gave only a very vague history of such attacks.

"Chronic retrobulbar neuritis" is a term which has been applied to cases manifesting a gradual loss of vision and field and an increase in optic atrophy, although the patient is unaware of an acute attack. Seven patients in the present series reported gradual loss of vision. In view of the nature of multiple sclerosis with its exacerbations and remissions, we feel that chronic retrobulbar neuritis probably does not occur in this disease; instead, there are repeated attacks on the optic nerve which only partially involve the fixation area and leave a certain amount of residual damage. At a somewhat later date the ophthalmologist, who examines such cases and observes the atrophy of the optic nerve, may be inclined to attribute it to a gradual disease process.

Ten patients showed optic atrophy, although they gave no history of loss of vision. We did not consider mere ophthalmoscopic evidence sufficient proof to place a patient in the group of multiple sclerosis cases; there had to be loss of vision, a field defect, or autopsy evidence of optic-nerve involvement

before a case was put into this category.

Leinfelder[7] states that several patients in his series with optic atrophy did not complain of visual loss, and he believes that they had a condition similar to chronic retrobulbar neuritis.

It is quite possible, however, that some of the patients in the later stages of the disease may forget an acute episode of visual disturbance. It should be underscored that most of the patients in this group retain vision of 20/30 or better and only have enlarged blindspots or paracentral scotomas, probably as residua of previous more extensive defects.

Laterality

Among patients who suffered from acute episodes, 20 had unilateral involvement, while 17 patients gave bilateral histories (table 2). Although we do not believe that we have seen simultaneous bilateral retrobulbar neuritis, it is possible that we have considered some of these cases in their early stages as toxic amblyopia. Several years after the attacks have occurred, the patients may report that they took place simultaneously even though in reality they were several weeks apart.

Recurrences

There were 10 cases in our series with known recurrences. In these, seven patients with multiple sclerosis had a single recurrence of an acute attack, and three had two or more (table 3). The second attacks occurred from one to five years after the initial attack, and were relatively mild in six patients and severe in four. It is very likely that many recurrences are missed, due to the fact that the patients are very ill when the recurrence takes place, or because they have so much visual impairment that they do not note subsequent attacks.

Among the patients with retrobulbar neuritis in whom multiple sclerosis has not been definitely proven, three had more than one attack of optic neuritis. In two of these there was very poor recovery, while the third retained good vision.

TABLE 2

Laterality of lesion

	Cases
Acute attacks	
Right	8
Left	12
Bilateral	17
Progressive loss of vision	
Bilateral	7
Left	1
No history of loss of vision	
Right	1
Left	2
Bilateral	7
Total	55

TABLE 3

Recurrences of acute attacks

	Mild	Severe	Cases
Recurrences—known multiple sclerosis			10
One attack—7	5	2	
2–4 attacks—3	1	2	
Recurrences—probable multiple sclerosis			3

Edema of the nervehead

Edema of the nervehead in optic neuritis due to multiple sclerosis has a low incidence. Sugar[8] found 36 cases in the literature and added two of his own. Benedict reported edema or swelling of the disc in eight of 90 Mayo Clinic patients with multiple sclerosis. Yaskin, Spaeth, and Vernlund found two cases of edema of the optic nerve among 35 cases.

We found seven cases with edema of the papilla in patients with multiple sclerosis. In most of these there was only blurring of the disc margins but one case showed numerous small hemorrhages around the disc and the edema extended to the macular area.

The infrequency with which papilledema is observed in multiple sclerosis is in distinct contrast to the relatively greater frequency

with which secondary rather than primary atrophy is noted. It is indeed probable that many acute attacks with edema are not observed at that stage.

The very fact that edema occurs may complicate the differential diagnosis between multiple sclerosis and brain tumor. Usually, however, the elevation in a case of papilledema due to neuritis of multiple sclerosis is of a low degree.

In some cases with intracranial tumors there may be very little elevation of the disc. Here the unilaterality and field changes will serve to differentiate multiple sclerosis from intracranial lesions. In one patient who had 6.0D. of elevation of the papilla of the left eye, an intracranial mass was found at autopsy to account for it. Zimmerman and Netsky[9] reported only two cases of intracranial neoplasm coincidental with multiple sclerosis.

Central vision

If there is an initial symptom of multiple sclerosis, chances for considerable recovery of central vision and field are good. Vision may not necessarily improve to 20/20 but it will usually be better than 20/50. Table 4 gives the details of the recovery of central vision in our cases. Visual acuity usually improves within a short period of time and may remain unchanged for many years. In 12 eyes, vision was 20/40 after the acute episode; in two others it was 20/50 six and eight years later, respectively.

TABLE 4

FATE OF VISUAL ACUITY FOLLOWING ACUTE ATTACK (46 EYES)

	Vision	Eyes
Onset multiple sclerosis with acute attack	20/20	4
	20/30	4
	20/40	4
	20/50	2 (6 & 8 yr. later)
	20/70	1(13 yr. later)
	20/100	1 (2 yr. later)
	20/200	4 (5–6 yr. later)
	nil*	1 (after 2nd attack)
Acute attack up to two years after onset of multiple sclerosis	20/20	2
	20/30	3
	20/40	1
	20/50	3
Acute attack two to four years after onset of multiple sclerosis	20/20	3
	20/40	1
	20/70	2 (5 yr. later)
	20/100	2 (? yr. later)
Acute attack over four years after onset of multiple sclerosis	20/30	1
	20/100	5 (2, 6 yr. later)
	20/200	2 (5 yr. later)

* This patient was not examined by us.

In those cases in which improvement does occur, it is not always complete. As a matter of fact some tell-tale evidence may remain in the visual field. If the area of greatest improvement happens to include the fixation point, vision may even return to 20/20. On the other hand, the surrounding area may similarly show varying degrees of improvement although the central vision may remain unimproved.

When we observe a patient with poor vision several years after the acute attack, it is difficult to know whether his visual loss is due to this acute attack, or whether he has actually recovered from this initial episode only to have lost vision because of subsequent unrecognized attacks. Those eyes in which vision is 20/70 or less following an initial acute episode that occurred less than four years after the onset of multiple sclerosis belong, with three exceptions, to patients who were examined over five years after the attack. On the other hand, in cases in which the acute episode occurred longer than four years following the onset of multiple sclerosis, only one eye regained 20/30, while seven had 20/100 or less.

Several possibilities may explain the poor vision in patients who have had multiple sclerosis for a long time:

1. Due to postneuritic atrophy, the contracting glial and connective-tissue scars may crush some of the optic-nerve fibers.

2. Recurrent attacks may be undetected because nystagmus or dysfunctions of the extraocular muscles may make diagnosis of the visual defect more difficult.

3. Attacks which occur late in the disease may be more severe than those occurring earlier.

A very interesting group is made up of those patients who do not report any loss of visual acuity but nevertheless show signs of optic neuritis (table 5). Such patients may have enlarged blindspots, paracentral scotomas, or partial nerve-fiber bundle defects which spare fixation. Since most of the patients retain good visual acuity, their condition may remain unrecognized if a careful field examination is not performed in every case of multiple sclerosis. As a matter of fact, several cases in our series, which were not detected during life and were only discovered after autopsy, revealed lesions in the optic nerve. In nine eyes, visual acuity was 20/30 or better; and in one patient it was 20/30 in both eyes even 20 years after the onset of multiple sclerosis.

Among the patients who had acute attacks in one eye, there were at least seven cases in which the fellow eye showed evidence of optic neuritis some years later even though the patient was not aware of an acute attack in the second eye. Usually the involvement was manifested by an enlarged blindspot or some other remains of a nerve-fiber bundle defect which probably spared fixation at its onset, thus remaining unnoticed by the patient.

TABLE 5

FATE OF VISUAL ACUITY IN PATIENTS WITHOUT HISTORY OF ACUTE ATTACK (26 EYES)

	Vision	Eyes
Progressive loss of vision		
2–5 yr.	20/50 or less	4
	20/70	2
Over 5 yr.	Counts fingers	1
	nil	2
No history of visual loss		
0–5 yr. after onset	20/30	4
	20/70	5
	20/100	1
Over 5 yr.	20/30	5
	20/70	2

AUTOPSY MATERIAL

Among 48 cases of multiple sclerosis examined at autopsy, 34, or 69 percent, had a history of ocular involvement. Unfortunately the eyes, optic nerves, and chiasms were not examined in every case so that it is difficult to know how many optic nerves were actually affected.

Lisch found evidence of optic-nerve involvement in every one of 12 cases of multiple sclerosis. Gartner reports that in 14 eyes from 10 cases there was some autopsy evidence of optic-nerve atrophy. In five other cases in which the eyes were not obtained, the optic nerve or chiasm showed pathologic defects at autopsy. Usually the optic radiations and occasionally the occipital lobe also showed plaques of demyelination.

In general the pathologic involvement is much more extensive than one would expect from the clinical findings. One patient with myopia had 20/30 vision in each eye shortly before death. She had had acute retrobulbar neuritis in the right eye approximately two years previously, followed by an attack in the left eye. Pathologic sections of her eyes showed extensive atrophy and demyelination of both optic nerves.

A second patient who suffered from bilateral retrobulbar neuritis 10 years prior to death had 20/25 in the right eye and 20/50 in the left a year before death. Autopsy revealed fairly marked demyelination of the optic nerves, chiasm, and tracts.

A third patient whose multiple sclerosis began with bilateral optic neuritis had vision of 20/50 in the right eye and 20/70 in the left eye six years later and shortly before her death. Autopsy revealed that the left optic nerve was much smaller in cross section than the right; there were numerous plaques in both optic nerves and tracts. Examples such as these lend proof to the observation that, even after the recovery of good visual acuity following optic neuritis, residual optic-nerve damage remains which can be revealed only by careful field study. Thus, the autopsy findings are much more extensive than one would expect from the clinical manifestations alone.

Primary lesions in multiple sclerosis occur in the myelin sheaths; cellular infiltration and connective-tissue reactions follow later.[9]

Gartner's studies demonstrate the similarity of lesions in the optic nerve to those in other central nervous system pathways. This implies that the primary lesion in multiple sclerosis is not inflammatory. The numerous cases of familial multiple sclerosis reported in the literature[10] lend further support to this premise.

The term "optic neuritis" has been used throughout this paper because it is the currently accepted terminology for the optic-nerve involvement in multiple sclerosis. That term implies an inflammatory process which, however, may not be present in this disease. Therefore, we believe that the term "optic neuropathy of multiple sclerosis" would be more in line with the demyelinating and degenerative character of multiple sclerosis.

Optic-nerve lesions in cases of probable multiple sclerosis

Among the 10 hospital patients with retrobulbar neuritis in whom clinical multiple sclerosis was not proven, three had recurrent attacks of retrobulbar neuritis; two cases differed from the usual course of multiple sclerosis in that the vision remained less than 20/200 after the second attack.

It is difficult to draw conclusions from the patients with retrobulbar neuritis in private practice because many of them have been observed for a short time only. In general, their course is similar to that of patients with multiple sclerosis. In two cases both the right and left eyes were involved at different times, and in three cases there were recurrent episodes in the same eye. It is possible that some cases with retrobulbar neuritis who never have any further attacks or other signs of the disease may suffer from a forme fruste of multiple sclerosis.

Any patient with retrobulbar neuritis in the age group between 15 and 50 years should be carefully examined for multiple sclerosis. We believe that a second attack is presumptive evidence of the presence of multiple sclerosis, even in the absence of other symptoms of the disease.

Optic-nerve lesions not due to multiple sclerosis

There were seven patients with retrobulbar neuritis in whom the disease apparently was not due to multiple sclerosis.

One patient had had an acute attack of bilateral retrobulbar neuritis 15 years prior to admission for metastatic carcinoma of the breasts. Since there were no other signs of multiple sclerosis over a period of 15 years, that disease may not have been present. (However, in rare instances visual disturbance may precede the onset of other signs of multiple sclerosis by even more than 15 years. In fact, Adie[11] has reported one case with an interval of 24 years.) At the time of examination, this patient's vision was 15/15, O.U., but there was considerable enlargement of the blindspots with some residual defect extending toward the paracecal area.

Three patients suffered from encephalomyelitis. In the first case, vision in the right eye was reduced to 10/70. Seven years later it was 15/40 in this eye, but vision in the left eye was reduced to 15/100. In the second patient the vision was reduced within three months to 20/70 in each eye. Neither of these patients showed edema of the nerve-head at any time. The third patient, however, showed a papillitis although the others did not.

One patient with mitral stenosis due to rheumatic heart disease and demonstrable thrombophlebitis showed a bilateral nerve-fiber bundle defect. The left nerve was pale and no blurring of the disc margins was noted at any time. Despite careful study the etiology of this lesion has remained unknown.

Another patient, aged 78 years, with rheumatoid- and osteo-arthritis, suffered from an attack of retrobulbar neuritis in the left eye and her vision diminished from 20/40 to finger counting at three inches. Her acuity has not shown any improvement. Arteriosclerosis probably played a role in the pathogenesis of this condition.

The last case was that of a 31-year-old woman with diffuse metastasis from a carcinoma of the breast. Her thyroid gland was moderately enlarged but she did not suffer from thyrotoxicosis. She suddenly lost vision in her right eye and, within four days, it was reduced to finger counting at six to eight feet. Three weeks later her vision had improved to 15/15−3 and a small cecocentral scotoma was still present for a 2/2,000 white test object.

We would like to compare these three cases with another in which there was a bilateral optic lesion. This patient was a 45-year-old man who had been treated for tuberculous nephritis for 17 years. When he was first seen at Montefiore Hospital, two years before his death, his vision was 15/20 in each eye. One and one-half years later he claimed that he had been losing vision for the past three months. At that time his vision was 15/200 in each eye. There were no other ocular symptoms. Bilateral cecocentral scotomas were plotted on the tangent screen.

At autopsy, there was bilateral optic atrophy on the temporal side corresponding in part to the papillomacular bundle. The chiasm also showed a great deal of atrophy in its posterior portion. In view of the bilateral nature of the disease and its rather insidious onset, a diagnosis of toxic amblyopia was presumed.

Since the patient did not smoke or consume alcohol, it was felt that one of the chemotherapeutic agents might have been responsible for the changes in his optic nerves. He had taken 101 gm. chloramphenicol, and this drug was considered to be the possible toxic agent. About the same time another patient who had received relatively large doses of chloramphenicol showed evidence of toxic amplyopia. However, we do not have any real proof for the indictment of this drug.

It is interesting to conjecture whether there is any essential difference between certain cases of retrobulbar neuritis and toxic amblyopia. We place a case into the second category largely because the disease is bilateral. Nevertheless, the ophthalmoscopic and visual field findings may be quite similar in both conditions. Where a toxic product, such as methyl alcohol, is the etiologic agent the term "toxic amblyopia" would be advisable. But when the etiology is unknown it seems rather arbitrary to label a case as "toxic amblyopia" just because both eyes are affected.

Summary

1. Of the 72 cases of optic neuritis reviewed, 83.3 percent were retrobulbar; 69.4 percent of the patients with optic neuritis had multiple sclerosis.

2. Visual disturbance was the initial symptom in 17 cases. In 19 cases the first attack of optic-nerve involvement occurred after a diagnosis of multiple sclerosis had been established by other means. Seven patients gave a history of gradual loss of vision while 10 patients did not give any history of visual loss.

3. In 10 cases there were known recurrences. It is possible that many recurrences remain undetected.

4. In only seven cases was edema of the nervehead observed. Nevertheless, secondary atrophy is more frequently noted than is primary.

5. Recovery is often incomplete and some tell-tale evidence often remains in the visual field. If the area of greatest improvement happens to include the fixation point, vision may even return to 20/20. Conversely, the surrounding area may show varying degrees of improvement although central vision may remain unimproved.

6. The pathologic involvement is usually much more extensive than one would expect from the clinical manifestations alone.

7. Since the lesions in multiple sclerosis are probably noninflammatory in origin, we have suggested the use of the term "optic neuropathy of multiple sclerosis" for this condition.

8. Among other causes of optic-nerve involvement were arteriosclerosis and encephalomyelitis.

9. One case is presented to show that bilateral lesions with a history of relatively insidious onset may not necessarily be different from other forms of retrobulbar optic-nerve pathologic processes simply because they are bilateral.

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THE RELATIONSHIP OF RETROBULBAR NEURITIS TO MULTIPLE SCLEROSIS*

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Rochester, Minnesota

An episode of acute retrobulbar neuritis is generally recognized as a possible primary symptom of multiple sclerosis. There is a paucity of information, however, as to the frequency with which multiple sclerosis actually develops after such an episode. Certainly many persons have an attack of acute retrobulbar neuritis, make good recovery, and then live out their life expectancies without ever having further neurologic difficulties.

In order to explore this problem, a follow-up study was conducted early in 1953 of the patients with acute retrobulbar neuritis of undetermined origin who had been seen at the Mayo Clinic in the period 1937 to 1942, inclusive. This permitted an elapsed interval of 10 to 15 years after the episode of acute retrobulbar neuritis. The purpose of the study was to ascertain the relative incidence of multiple sclerosis among these individuals.

A total of 118 patients whose condition fitted the established criteria for acute retrobulbar neuritis had been seen at the Mayo Clinic during the selected period. Twenty-five of the patients could not be located. Six others died before 10 years had elapsed since their initial bout of retrobulbar neuritis and, consequently, they were not included. In none of these six cases, however, had multiple sclerosis developed before death.

* From the Mayo Foundation and the Section of Ophthalmology, Mayo Clinic. Abridgment of part of a thesis submitted by Dr. Taub to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Ophthalmology.

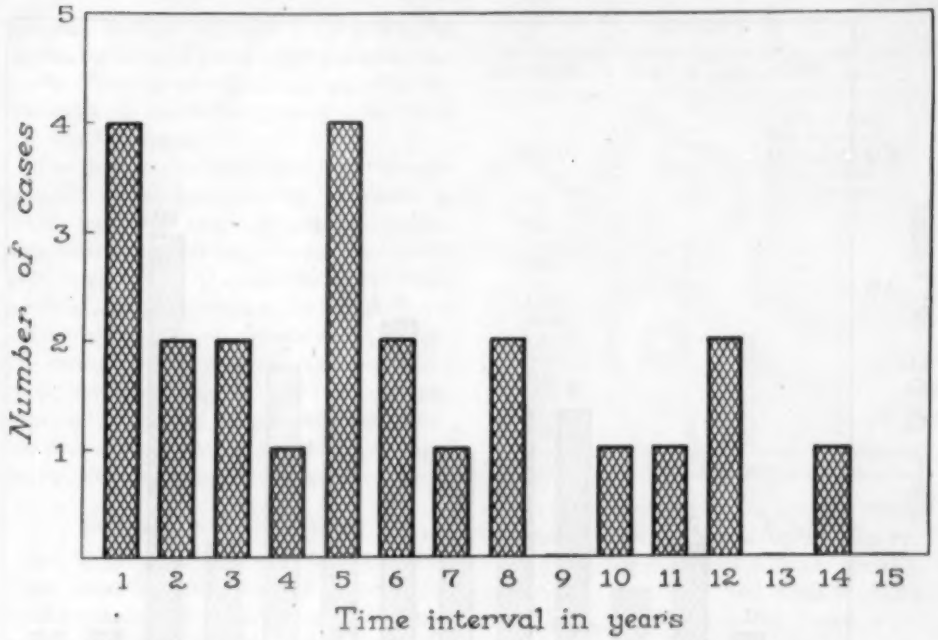

Fig. 1 (Taub and Rucker). Time interval between episode of acute retrobulbar neuritis and appearance of other signs of multiple sclerosis in the 23 cases in which the interval could be determined.

Eighty-seven cases, then, were available for study.

For analysis of the data, the patients were divided into three groups, according to their ages at the time of their initial bout of retrobulbar neuritis. Patients of Group 1 were younger than 20 years of age; those of Group 2 were 20 to 44 years of age, inclusive; those of Group 3 were more than 44 years of age.

Of the seven cases of the first group, in one multiple sclerosis developed five years after the initial bout of retrobulbar neuritis. The patient was a girl who had had retrobulbar neuritis at the age of 12 years.

The second group contained 57 cases. Of this number, in 26, or 45.6 percent, multiple sclerosis developed. The time between the initial bout of retrobulbar neuritis and the development of symptoms of multiple sclerosis could be determined in 23 of the 26 cases and ranged between one and 14 years. In more than half of the 23 cases, the onset of multiple sclerosis fell within the first five

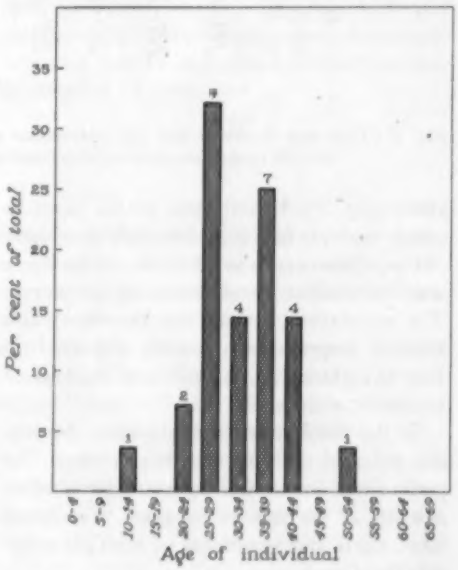

Fig. 2 (Taub and Rucker). The age distribution at the time of an initial episode of acute retrobulbar neuritis in individuals who later developed multiple sclerosis.

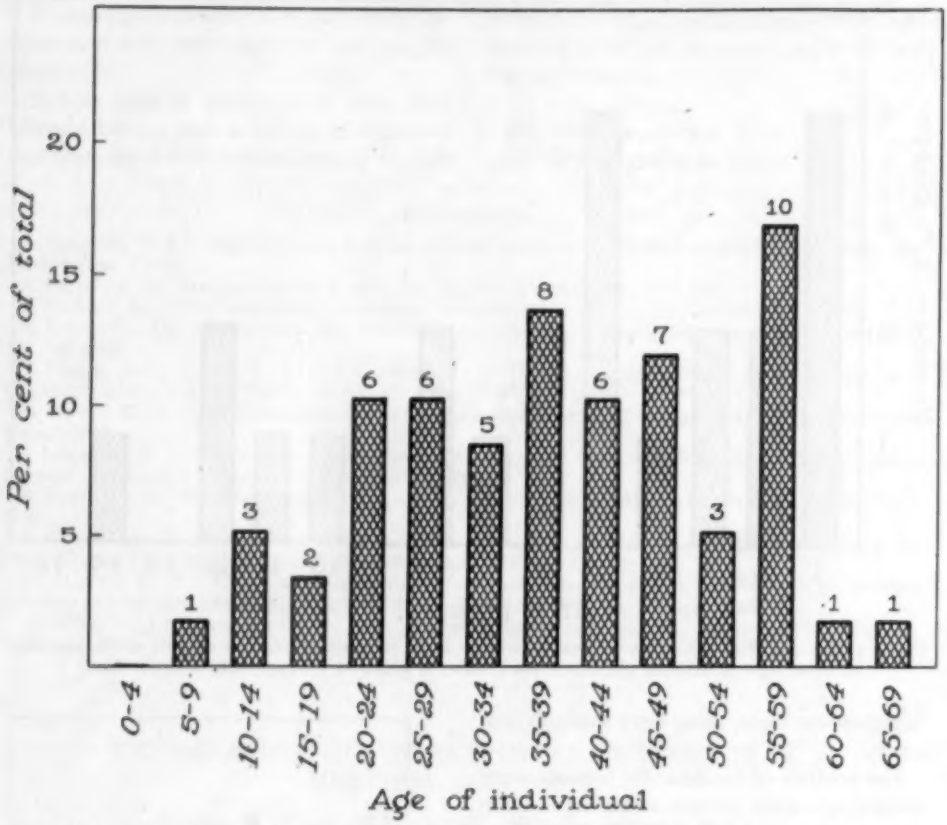

Fig. 3 (Taub and Rucker). The age distribution at the time of an initial episode of acute retrobulbar neuritis in individuals who did not develop multiple sclerosis within 10 to 15 years.

years (fig. 1). In only two of the cases in which multiple sclerosis ultimately developed did papillitis occur; in all of the others there was retrobulbar involvement of the nerve. The retrobulbar neuritis was transitory and marked improvement usually occurred in four to eight weeks, regardless of the type of treatment employed.

In the third group were 23 cases. In only one case did multiple sclerosis develop. The patient was a man who had acute retrobulbar neuritis at the age of 52 years. Ten years later, signs and symptoms of multiple sclerosis developed.

Of the entire group of 87 cases, in 28 (32.2 percent) multiple sclerosis developed in the course of the follow-up period of 10 to 15 years.

If all the cases in which multiple sclerosis developed later are divided into smaller groups, according to their age at the time of the initial episode of retrobulbar neuritis, and these groups are plotted against the percentage of the whole group (fig. 2), it becomes apparent that, in the greatest number of cases, the retrobulbar neuritis occurred when the patients were between the ages of 25 and 39 years. The mean age at the time of the initial bout of retrobulbar neuritis was 35 years.

In Figure 3 are represented those cases in which, after an initial bout of retrobulbar

neuritis, multiple sclerosis did not develop within the 10 to 15 years encompassed by the study. There is no significant age peak for the onset of retrobulbar neuritis; the mean age was 38.2 years.

The data in the series also were investigated from the standpoint of the month in which the initial attack of retrobulbar neuritis occurred. This information was available in 74 of the 87 cases (table 1). Relatively few cases occurred in the months from November to March, inclusive. Although the series is small, this observation appears to be statistically significant. It is also unexpected in view of the generally held opinion that chilling may be a factor in precipitating exacerbations of multiple sclerosis.

TABLE 1

THE DISTRIBUTION OF THE CASES* ACCORDING TO THE MONTH OF ONSET OF RETROBULBAR NEURITIS

Month	No. of Cases	No. of Cases Which Developed Multiple Sclerosis in the 10- to 15-year Interval
Jan.	3	0
Feb.	2	0
Mar.	4	1
Apr.	14	6
May	6	3
June	11	2
July	4	1
Aug.	3	1
Sept.	12	5
Oct.	6	4
Nov.	5	1
Dec.	4	1

* Data available in 74 of the 87 cases of the series.

SUMMARY AND CONCLUSIONS

Of 87 patients followed for 10 to 15 years, after an initial bout of acute retrobulbar neuritis, 28 (32.2 percent) developed evidence of multiple sclerosis. Twenty-six were in the age group of 20 to 44 years at the time of the initial bout.

Our data indicate that an individual of that age group, who has an attack of acute retrobulbar neuritis, has a 40 to 50-percent chance of having multiple sclerosis develop within 10 to 15 years. In the cases in which retrobulbar neuritis occurs before the age of 20 years, the chance of multiple sclerosis appearing is less likely, and when it occurs after the age of 44 years, the chance is remote.

In a general way, one might deduce that, in about half the cases in which retrobulbar neuritis occurs between the ages of 20 and 44 years, inclusive, other signs of multiple sclerosis may be expected to develop within a period of 15 years.

OPHTHALMIC MINIATURE

A man aged 50, who was in good health, and had previously had good sight, was one day engaged, for a longer time than usual, stooping over a bench, cutting leather. On the following morning he had the subjective symptom of drops of water falling rapidly, one after the other, from his hat brim. This appearance was before his left eye only, and it continued all day, and more or less for several days. Next he saw all flames of a green or blue colour, and then he had "electric flashes of light" in his eye. Three weeks later he could perceive objects only in the lower and inner part of the field.

Jonathan Hutchinson,
Archives of Surgery, 1:95, 1890.

APLASIA OF THE OPTIC NERVE*

Report of three cases

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Aplasia (hypoplasia) of the optic nerve presents a striking ophthalmoscopic appearance when seen in an otherwise normal eye. Compare Figures 1, 2, and 3 with Figure 4.

Fig. 1 (Smith). *Case 1. M. L. A.* Photograph of fundus drawing of the right eye.

In such instances, it is an anomaly of great rarity[1] which, in the few cases recorded to date, occurs with about equal frequency bilaterally and unilaterally.

The condition is not uncommonly found in association with other major ocular and central nervous system deformities, that is, microphthalmos,[2] cyclopia,[3] orbital meningoencephalocele,[4] and anencephaly,[5] specimens from which much of our information concerning the pathology of the ocular structure in the anaplastic optic-nerve condition is derived.

A critical review of the literature with reference to this anomaly made by Scheie and Adler[6] revealed three previously described instances of bilateral aplasia[7-9] and two observed unilaterally.[10,11] Their paper added one case of bilateral aplasia to the literature. Walsh[12] subsequently reported one case of unilateral aplasia. This paper adds to the literature one case in which the condition is bilateral and two cases in which the condition is unilateral.

Histologic examination of specimens provided by the aforementioned anomalies gives us a reasonable understanding of the possible pathologic process. Rosenbaum,[13] Frazier,[14] Mayou,[15] and Walsh[16] have described the

Fig. 2 (Smith). *Case 1. M. L. A.* Photograph of fundus drawing of left eye.

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* Presented before the Pacific Coast Oto-Ophthalmological Society, May 31, 1951, Victoria, British Columbia.

Dr. Dean Spear, Salt Lake City, Utah, courteously permitted me to examine two unrelated infants, recently seen by him, each of whom had bilateral pathologic conditions identical to Case 1 herein presented.

Dr. L. W. Oaks and Dr. J. H. Quinn, Provo, Utah, have recently seen two additional cases of optic-nerve aplasia (personal communication) in infants. One patient presented bilateral pathologic findings, while the other had a unilateral aplastic optic nerve. In addition, they have a three-year-old patient who presents findings similar to those described by Briere. This case is to be the subject of a future publication by them.

ocular findings in the anencephalic monster and found the gross structure of the eyes usually to be normal. However, the optic discs were small, the retinal ganglion-cell and nerve-fiber layers were absent (fig. 5), the optic-nerve stalks were small and devoid of axis cylinders. The retinal vascular systems were normal and emerged from the papilla in the customary fashion. Additional studies of microphthalmos, cyclopia, and orbital meningo-encephalocele reveal similar histologic data.

The report of the ocular examination and pathologic findings in the congenitally blind cat, by Zeeman and Tumbelaka,[17] adds to our information, and presents an example of a true optic-nerve aplasia. The retina, pigment epithelium, choroid, and sclera were uninterrupted in their continuity; hence, neither the papilla nor the central retinal vessels were present. The ganglion-cell and nerve-fiber layers of the retina were absent, and the optic-nerve fibers, the optic chiasm, and the optic tracts were missing.

Szymanski's[18] chance observation and subsequent histologic study of the eyes of a cat revealed findings in the left eye similar to those in the specimen of Zeeman and Tumbelaka. In Szymanski's specimen, the nerve-fiber layer had been replaced by fibrous tissue, and the ganglion cells had some nuclei which were without surrounding protoplasm. The optic nerve ended blindly in the posterior aspect of the globe; it did not penetrate the sclera.

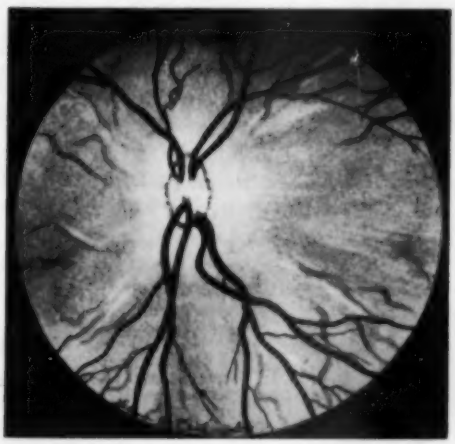

Fig. 3 (Smith). *Case 2. C. E.* Photograph of fundus drawing of left eye.

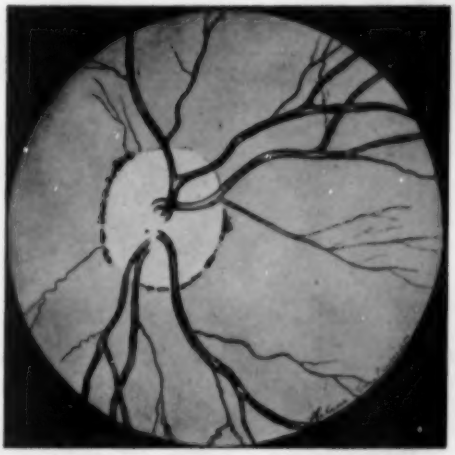

Fig. 4 (Smith). Photograph of a drawing of the normal fundus of an adult left eye.

The right eye revealed an optic disc with a large excavation. The vessels emerged in the same way as is seen in the glaucoma excavation. The sections revealed the temporal retina to be normal, but the nasal retina was similar to that seen in the left eye. This right eye is somewhat similar to the eyes in the one-year-old blind child reported by Ridley.[19]

In the description of Ridley's case, the optic discs were small, a deep excavation was present, and the central retinal vessels were only threadlike cords with very little blood content. The child was blind.

The hereditary optic-nerve aplasia in mice, described by Bein,[20] increases the scope of the neurologic involvement. His report was preliminary and further information can be expected from the same studies. The optic-nerve defect occurred in different forms, either hypoplastic or aplastic, unilateral or bilateral, or with aplasia on one side and hypoplasia on the other side. A deficiency in neural elements could be traced in varying degrees to the striate area.

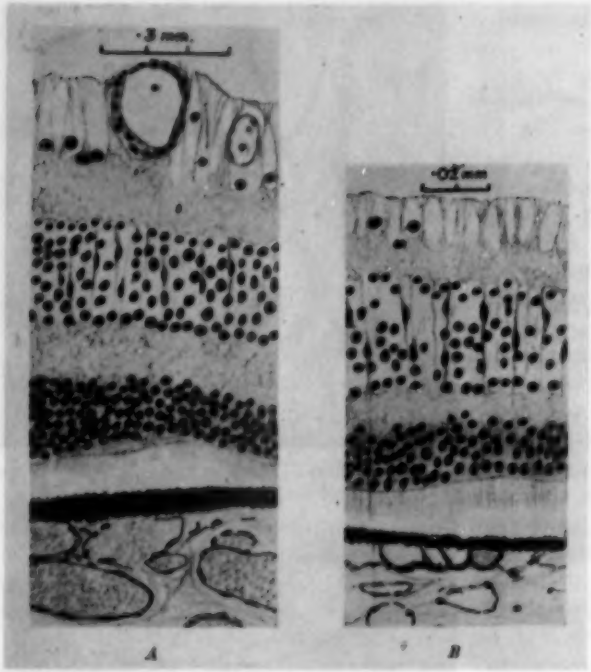

Fig. 5 (Smith). (A) and (B) both show sections through the retina of an anencephalic fetus at term. In (A) a blood vessel is seen lying at the surface of the retina. In (B) there is extreme atrophy of the nerve-fiber layer and absence of ganglion cells. (From Mann, I.: *Development of the Human Eye.* London, Cambridge University Press, 1928.)

The etiologic background is not clear, but in considering it embryologically, certain features stand out (fig. 6).

First, if by the 10-mm. stage, the paraaxial mesoderm has failed to grow through the upper part of the fetal fissure of the optic cup, it is conceivable that the fissure would close completely. This would result in an absence of the optic nervehead and the central retinal vessels. This would be a true optic-nerve aplasia. Such was the picture described by Zeeman and Tumbelaka and by Szymanski in the eyes of the cats studied by them. This type of defect in the human has been seen only in association with grossly deformed eyes[21, 22] which usually show concomitant major structural defects expected in growth aberrations.

Second, by the 17-mm. stage (fig. 7), the retinal ganglion cells have appeared in the inner layer of the optic cup around the primitive papilla. The dendrites originating from these cells can be seen lying in the non-nucleated area of the layer, and can be followed into the optic stalk. This process continues to contribute the neural elements to the papilla and optic nerve.

An anomaly of retinal differentiation in the ganglion-cell layer about this time could result in a condition in which the residue of the optic stalk with a normal retinal vascular structure would be present. However, there would be no neural tissue in the optic nerve or papilla, and the retina would show an absence of the ganglion-cell and nerve-fiber layers. Such an optic disc would be expected to appear small, white, and have essentially normal central retinal vessels.

Report of cases

Case 1

On March 8, 1949, a three-month-old white boy (M. L. A.) was referred to our office by Dr. Mazel Skofield for apparent blindness. He had delivered the baby and stated that the prenatal parturition and post-

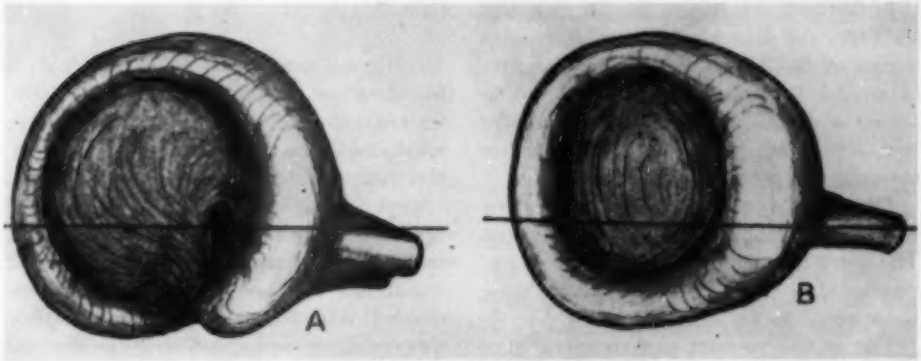

Fig. 6 (Smith). (A) Model of an optic cup showing the fetal fissure and the continuity of this with the groove on the under surface of the optic stalk. (B) Imaginary model, showing the condition which would have resulted if invagination had taken place from the outside only, instead of from the outside and below. No fissure is present. (From Mann, I.: *Development of the Human Eye*. London, Cambridge University Press, 1928.)

natal course were normal. There was no family history of ocular pathology.

General physical examination was essentially negative. The ocular examination revealed the eyes to have purposeless movements, but the excursions appeared to be within normal limits. The anterior segments were normal. The pupils were round and regular and at four mm. The right pupil reacted well to consensual light stimulation only. The left pupil reacted to direct light stimulation only and the response was minimal. The irises were a normal blue color.

Ophthalmoscopic examination of the right eye (fig. 1) revealed the media to be clear. The optic disc was small (one third the normal size), white, and vertically oval. The central retinal vessels were normal and an optico-ciliary vessel was present on the temporal side.

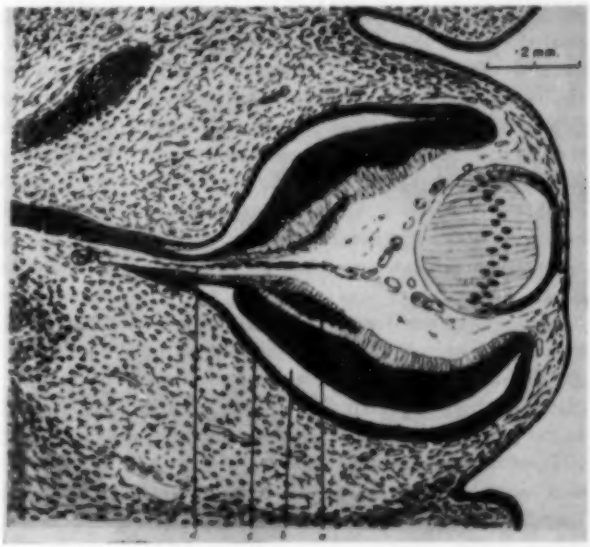

Fig. 7 (Smith). Section through the optic cup and stalk of a 17-mm. human embryo. (a) Inner layer of cup with inner neuroblastic layer. (b) Cavity of primary optic vesicle. (c) Outer pigmented wall of cup. (d) Hyaloid artery in the upper end of fetal fissure. (From Mann, I.: *Development of the Human Eye*. London, Cambridge University Press, 1928.)

In the vertical meridian the disc measured six times the diameter of the first division branch of the central retinal artery, and the horizontal diameter was four times the diameter of the same vessel. The disc was filled with supporting glial tissue, and a shallow optic cup was present.

The margin was distinct, except temporally, where pigment was accumulated. The sclero-choroidal canal was small and corresponded with the size of the disc. No nerve tissue could be distinguished in the disc.

The retinal vascular pattern appeared to be normal. No macular area of specific differentiation could be discerned. An increased amount of pigment was arranged in granular fashion in the area which would correspond with the size of a normal disc. There was some accentuation of the pigment at the disc margin. The area adjacent to the disc was lighter in color than the remainder of the fundus.

The disc of the left eye (fig. 2) was similar in every respect to that of the right eye, except for nerve tissue occupying one sixth of the disc area in the inferior nasal quadrant. No optico-ciliary vessel was present.

There was no significant refractive error present, as determined in the homatropine dilated eye of the child examined under a general anesthetic. The discs appeared to be similar to those in the case described by Scheie and Adler.

Course. The child manifested only light perception as he grew older. Again on November 26, 1950, a detailed fundus study was done under a general anesthetic, and the accompanying drawings were made at this time.

Nystagmus was present. The fundi were unchanged except for some diminution of the pigment density in the area around the discs. A slight granular appearance showed in the pigment epithelium. Still, no definitely isolated area of retinal macular differentiation was apparent. There was no central macular reflex present in either eye.

CASE 2

C. E., a four-year-old white boy, was referred to our office on November 28, 1950, for evaluation of poor vision in the left eye associated with a left esotropia of 10 degrees. His mother stated that she first noticed the left eye turning in at one year of age. At the age of three years she had the boy's eyes examined. Poor vision was found in the left eye at this time and occlusion was recommended. With the right eye covered, the boy was visually incapacitated, so the mother did not pursue the occlusion.

The family history was essentially negative.

Ocular examination revealed an essentially normal right eye with good visual acuity. The anterior segment was normal. The pupil reacted to light both directly and consensually. The reaction of each pupil to accommodation by the right eye was normal.

The media were clear. The fundus was normal.

The left eye (fig. 3) had light perception only, and an esotropia of 10 degrees was present with the eyes in the primary position. The ocular excursions were normal. The anterior segment was normal; the pupil reacted slightly to direct light stimulation and well to consensual stimulation. The media were clear.

The fundus revealed a normal vascular pattern. The hue was a little more pale than usually seen and this paleness was most marked in the area around the disc.

The disc was well demarcated, white, and vertically oval. In the vertical meridian, it measured about eight times the diameter of the first division branch of the central retinal artery, and in the horizontal, five times the diameter of the vessel. No nerve tissue could be seen, and the disc area was filled with glial tissue. The size was a little more than one third the normal size of the disc.

An atropine refraction revealed: R.E., +1.5D. sph. ⊂ +0.25D. cyl. ax. 95°; L.E., +0.75D. sph.

CASE 3

J. A. E., a four-year-old white girl, was seen on May 10, 1950. The mother stated that the vision was poor in the left eye and that occasionally the left eye turned out. They had just recently discovered the visual defect in the left eye.

The child had an uncomplicated birth with a normal childhood. The family history was essentially negative.

Ocular examination revealed the eyes to be straight in the primary position. The extraocular muscle actions were normal; the child was unable to fix with the left eye. The anterior segments were normal; the right pupil reacted directly to light and the left one consensually.

Stimulation of the left eye with light evoked a minimal direct pupil constriction and a slight consensual reaction in the right pupil. The vision in the right eye was good, but light perception only was present in the left eye.

Except for a slight vertical oval appearance of the optic disc, the right fundus was normal.

Fundus examination of the left eye revealed the media to be clear. The retinal vascular pattern was normal, but no area of macular differentiation could be made out. The optic disc was small—less than one-half the normal size, and the vessels emerged from the depths of the disc to run nasally to the surface of the disc where they bent to the retina. The axis of the optic cup slanted toward the temporal side. No nerve tissue could be distinguished. Marked granular pigment dots were present around the disc in an area corresponding to the size of a normal disc. There was an increase in density and number of pigment granules on the temporal side of the disc.

An atropine refraction revealed the following: R.E., +0.75D. sph.; L.E., −4.0D. sph.

COMMENT

A review of the literature bears out Cords' statement that the condition is infrequently seen in an otherwise normal human eye. The pathologic findings have, to date, been obtained by the study of the eyes of cats and from human eyes which were obtained because of associated ocular or central nervous system pathology.

From an embryologic point of view, in a true optic-nerve aplasia there would be no optic disc and no central retinal vessels. Such a defect would necessitate interference with the embryo's growth prior to the 10-mm. stage. In the hypoplasia group, to which these cases belong, an aberration of retinal growth must occur between the 10-mm. and 17-mm. stages. Such eyes would be expected to show small optic discs with normal central retinal vessel structures.

Congenital pigmentation, coloboma, and atrophy of the optic nerve must be excluded.

SUMMARY

Three additional cases of hypoplasia of the optic nerve have been presented. One case presented bilateral pathologic findings and the other cases presented unilateral ones. The eyes were otherwise normal. There was no associated neurologic disturbance; nor was there any familial history of ocular disorders.

508 East South Temple (2).

I am indebted to Dr. Scott M. Smith for giving the anesthetic and to Mrs. Helene Cartwright for the fundus drawings shown here.

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IRIDECTOMY IN NARROW-ANGLE GLAUCOMA

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San Francisco, California

MODE OF ACTION OF IRIDECTOMY

The concept that the action of iridectomy consists of mechanical opening of the angle of the anterior chamber was introduced by Weber in 1877.[1] It was supported by Collins,[2] E. Fuchs,[3] and others, who found the angle open in anatomic specimens of acute glaucoma in which early operation had normalized the intraocular pressure. Other theories which suggested that a reflex stimulus to oversecretion is interrupted or that vasomotor reflexes are cut did not find favor. Von Graefe[4] observed the occasional formation of a filtering scar.

Increased communication between anterior and posterior chambers was suggested as a factor in the action of iridectomy by Coccius,[5] Leber,[6] and Czermak.[7] The latter believed that, as a result of a difference in pressure, the fluid in the posterior chamber pressed the root of the iris against the angle wall and, when the iris contacted the ring of Schwalbe, the aqueous remaining in the closed space drained off into Schlemm's canal. Czermak postulated that an opening in the iris near its root in acute glaucoma relieves the difference in pressure and permits the angle to open.

Panas,[8] in 1884, and Knies,[9] in 1893, having accidentally pierced the iris with the knife in congestive glaucoma, omitted the iridectomy (iridosclerotomy). They regarded the increased communication between anterior and posterior chambers as a factor in the action of iridectomy.

To avoid the technical difficulties of iridosclerotomy and still preserve the sphincter, Pflüger[10] introduced peripheral iridectomy in 1893. Wolflin,[11] in 1908, Grosz,[12] in 1913, Illig[13] and Safar,[14] in 1921, recommended peripheral iridectomy but the operation did not come into common use.

In 1920, Curran[15,16] revived interest in peripheral iridectomy on the basis of a technique of iridotomy which he found effective in acute glaucoma and in cases of chronic glaucoma in which the chamber was shallow and the iris "hugged" the lens. His objective was to drain aqueous from the posterior into the anterior chamber. He contended that "in glaucoma the passage of aqueous through the pupil from the posterior to the anterior chamber is impeded on account of the iris hugging the lens over too great a surface extent. Some of the aqueous gets through while some passes back, forcing the iris and the lens still more forward."

In 1922, Baenziger[17] suggested that the cause of acute glaucoma is increase of pressure in the posterior chamber, as a result of which the root of the iris is pressed against the cornea. He cited Ulbrich,[18] Heine,[19] and Urbanek,[20] who observed in cases with congenital defect of the iris that under physiologic conditions the iris diaphragm offers an impediment to free flow between anterior and posterior chambers. He further suggested that in primary glaucoma a similar, although more severe degree of, mechanical impediment was the cause of the trouble. Following this line of reasoning, he performed a small peripheral iridectomy with excellent results on one patient who had been suffering from prodromal attacks.

Gonioscopic investigations

With the introduction of gonioscopy in 1907 by A. Trantas,[21] the filtration angle was exposed to direct study in the living subject. After the anatomy of the angle was classically described by Salzmann,[22] the method was further developed and elaborated upon,[23–30] making possible a more intimate analysis of the effects and mode of action of iridectomy.

Troncoso's gonioscopic studies[31] encouraged the view that a factor in the action of iridectomy was re-establishment of communication between posterior and anterior chambers. Other gonioscopic studies supported the earlier view of Weber,[1] E. Fuchs,[3] and Collins[2] that iridectomy acts primarily by directly opening the closed angle in the area of the coloboma and the adjacent region.

The theory of mechanical block of the angle as the cause of the increase in pressure was disturbed by reports of successful iridectomy in which the angle appeared gonioscopically closed and vice versa.[27, 32–34] These isolated observations have lacked confirmation. More recent studies suggest that the divergent opinions probably were due to the inadequacy of the methods of gonioscopy employed and of the classification of the primary glaucomas used at that time.

In 1938, I published gonioscopic and surgical observations which added further evidence[38, 42, 43] that the specific action of iridectomy consists in short-circuiting the pupil with ensuing collapse of the iris bombé and opening and widening of the angle. It was shown that for iridectomy to unfold its specific action the incision through which it is performed should be immediately and completely sealed and that a leaking wound and delayed reformation of the peripheral chamber must be avoided. It was concluded that a relative pupillary block (increased seclusion) was a main factor in the pathogenesis of "narrow-angle (iris-block) glaucoma."

Selection of cases

It was evident that in order adequately to analyze the mode of action of iridectomy, cases would have to be selected according to a classification which was more accurate than the customary grouping into congestive and noncongestive or simple glaucoma.

Raeder,[35] in 1923, and Rosengren,[36] in 1931, had suggested grouping primary glaucomas according to the axial depth of the anterior chamber. However, since these observers did not employ gonioscopy, they could not correlate the axial depth of the chamber with the findings in the angle. Moreover, measurements of the axial depth of the anterior chamber combined with gonioscopic

observations[39] have shown that the axial depth, although it is suggestive in many cases, cannot be employed as a basis for a consistent classification.

I recommended, therefore, that the primary glaucomas be grouped on the basis of the findings in the chamber angle, into those in which closure of the angle by the root of the iris is the cause of the increased pressure and those in which this is not the case. In the latter the obstruction was presumed to be in or near the angle wall or trabeculum.[28, 42, 43] The terms "narrow-angle" (iris-block and "open- (wide) angle*" were suggested for the two groups as being preferable from various points of view to the time-honored division into congestive and noncongestive or simple glaucoma. In addition to gonioscopy, all the clinical findings and history were taken into consideration in the classification. It is based on fundamental differences and not only on gonioscopic appearances.

Present investigations

A study of over 100 cases of iridectomy was made on the basis of this classification. Early in the series iridectomy was performed through a self-sealing valvelike corneal incision. Conclusions arrived at by operating on 15 cases in this manner were reported in 1938.[28, 42] Later in the series an ab externo technique was developed in which the incision where it enters the chamber was so small as to prevent loss of the anterior chamber. It was sealed by a prelaid suture. In this manner the specific action of iridectomy could be observed unencumbered by extraneous effects such as follow a leaking wound. It was found that as a result of collapse of the bombé of the iris and short-circuiting the increased seclusion of the pupil, the trabeculum was exposed to aqueous.[28, 39, 41, 43] These conclusions have been confirmed by Haas and Scheie[44] and elaborated by Chandler[45] who, in his description of the ab externo technique, also emphasizes the need of a sealed incision to prevent postoperative adhesions in the angle.

Method of investigation

Gonioscopy was performed with a Koeppe glass contact lens, a focal illuminator devised for this purpose,[57] and binocular microscope (magnification ×20) mounted on an adjustable stand with the patient in the recumbent position.[29, 58] The total magnification is ×30, due to the contact lens.

I have found that this method, which I have developed over the course of the years, gives markedly better results because of the increased magnification and much greater intensity of illumination and flexibility than the methods which use the plastic lens of Goldmann or Allen with the patient in the upright position in front of the slitlamp microscope.

The usual routine slitlamp examination of the anterior segment was used in all cases.

The axial depth of the anterior chamber was measured with the Ulbrich drum and in some cases with the apparatus of Stenstrom.[27, 64]

By means of gonioscopy combined with measurements of the axial depth of the anterior chamber, the structure and position of parts in different eyes as well as in the same eye were compared before and after iridectomy.

When measuring the axial depth of the anterior chamber with the Ulbrich drum, readings were made from the vertex of the cornea to the pupillary border of a pupil two mm. in diameter and were repeated five to 10 times. The pupillary size was maintained the same for successive measurements. It was found that the maximum spread of 10 successive measurements was 0.1 mm. on the drum. Cases were not used in which poor co-operation of the subjects was such that successive measurements did not come within this range of error. The units of measurements of the Ulbrich drum give the apparent depth of the anterior chamber in millimeters. It was not considered necessary

* The term "open-angle" is preferred to "wide-angle" which was originally suggested as being less equivocal.[4]

to measure the corneal curvature and to obtain values for the actual depth of the anterior chamber by using the formula of Hartinger[46] since this would have involved differences of only a fraction of a tenth of a millimeter.

The measurements made with the Ulbrich drum have recently been checked by the method of Linstedt[64] (apparatus of Stenstrom). The spread of successive measurements with this method was less than 0.06 mm. The values agreed with the Ulbrich drum within 0.1 mm. The measurements with the Ulbrich drum were, therefore, sufficiently consistent and accurate to be used with advantage for comparative purposes in this series. However, since they do not represent absolute values they cannot be compared with values obtained by other methods.

The objective in this series was to determine whether changes in the axial depth of the anterior chamber occur and their nature, that is, changes in position of the lens in its relation to the vertex of the cornea during the glaucomatous process, pre- and postoperatively, and over a period of time.

The study was made on cases classified as narrow-angle glaucoma. Several cases of open- (wide) angle glaucoma in which iridectomy had been performed were included as controls because, by their negative evidence, they provided information which was significant.

Study of specific action of iridectomy

First a study was made of the influence on iridectomy of various types and locations of incision (Graefe scleral incision, scleral scratch incision ab externo with and without sutures, corneoscleral trephination, iridencleisis, and a self-sealing beveled valvelike corneal keratome incision.[28, 50] The effects of the different incisions were compared and related to their being in sclera or cornea, whether sealed or not,* and to their distance from the root of the iris.

If an iridectomy is performed with an incision which is not completely sealed, leakage of the wound encourages delayed reformation of the chamber and of the chamber angle and postoperative adhesions in the angle and pupil. Leakage of the wound may also initiate a malignant course in a predisposed eye since it encourages a forward displacement of the lens-iris diaphragm. In iridectomy with a very small sealed ab externo incision and retention of the anterior chamber, there was little if any tendency to formation of adhesions in pupil or angle. It probably also discourages the development of a malignant course.

An analysis of the reasons for success or failure of iridectomy showed that an effective study of the specific action of iridectomy could only be made when the iridectomy was performed with an incision which was immediately and completely sealed. Early in the series this was accomplished by a valvelike corneal keratome incision; later in the series by a very small sutured ab externo incision.

Peripheral iridectomy was made whenever possible in order to preserve the sphincter.

Peripheral iridectomy performed through a self-sealing valvelike corneal incision

Iridectomy was made basal through a self-sealing corneal incision by means of a technique† involving a preliminary deepening of the anterior chamber[28, 42, 47, 48] and a special angulated forceps.

The inner wound is one to two mm. anterior to the corneoscleral border. The reformation of the chamber is awaited while the patient is on the operating table. As the anterior chamber reforms the bombé of the iris is collapsed, the entrance to the angle widens and stays open throughout the circumference exposing the trabeculum to aqueous and at the same time preventing the post-

* In 1891, von Graefe[4] pointed out that his iridectomy incision, which was one mm. peripheral to the cornea and thus in scleral tissue, united more slowly than a corneal incision and, for this reason, resulted in a cystoid scar and fistulization in about 15 percent of cases.

† A description of this technique is in press.

operative formation of peripheral adhesions. This technique was superseded by the following later in the series.

Peripheral iridectomy pfrformed with a small ab externo incision sealed by prelaid sutures

This technique employed a six to eight mm. high, limbal-based conjunctival flap, a scleral scratch incision vertical to the surface of the globe and five mm. long in order to supply good visibility. It is placed 1.5 to two mm. posterior to the corneoscleral border at the 11- or 1-o'clock positions. The margins of the scleral wound are spread apart by means of a prelaid suture. The deep layers of the incision are divided by scratching with the point of the keratome under full visibility, using ×2 magnifying loupe. Where the incision enters the anterior chamber it should not measure more than one to 1.5 mm. This technique is similar to that described by Chandler[48] but the size of the internal incision (the last layers of transparent corneal tissue) is smaller.

If the incision where it enters the anterior chamber is sufficiently small and close enough to the root of the iris, the fluid in the posterior chamber will consistently cause the iris to prolapse into and plug the wound before any aqueous can escape from the anterior chamber. If the iris does not prolapse exteriorly so that it can be grasped, it can be made to present by the assistant slightly stretching apart the wound margins combined with pressure exerted on the sclera posterior to the wound. The prolapse is grasped at its base and the root of the iris is stretched to either side before cutting (in two cuts) with a small Barraquer iris scissors, in order that when the iris snaps back, the coloboma may extend beyond the inner wound, thus discouraging adhesions and assuring basality.[89] This manner of making the sclerocorneal incision and the excision of the iris avoids the need of having to enter the chamber with an instrument.

Advantages of the ab externo method over that employing a corneal incision are the ease of performance and its safety. The chamber is retained or if by chance some of it is lost it is rapidly restored provided the internal incision is not over one to 1.5 mm. long and the scleral incision is sealed by a suture. Unless these premises are fulfilled ab externo incisions, since they are in scleral tissue, are prone to leak.

Results of investigations

Action of iridectomy

1. The action of peripheral iridectomy performed through an incision which is immediately and completely sealed was found to be as follows:

a. *The anterior chamber is retained or if lost in part it reforms at once.*

b. *Collapse of the iris bombé occurs immediately widening the angle throughout its circumference* and giving aqueous access to the trabeculum. This is the result of short-circuiting the increased functional seclusion or pupillary block. The iris becomes flat, its furrows increase, and the physiologic midperipheral iridodonesis observed gonioscopically reappears due to reduction of pressure differential between the anterior and posterior chambers. The widening of the angle throughout the circumference prevents postoperative peripheral adhesions. Since the chamber stays reformed these changes are permanent (figs. 1A and 1B).

c. *When the coloboma is truly basal, widening of the angle is greater in the region adjacent to the coloboma.* In this sector the sphincter is flattened and comes to lie a little more centrally; the iris is more stretched as shown by the absence of furrows, as noted by Pflüger. This is evidently due to excision of a piece of the dilator and its nerve plexus. As a result of these changes, the action of the sphincter is encouraged and this, in turn, further

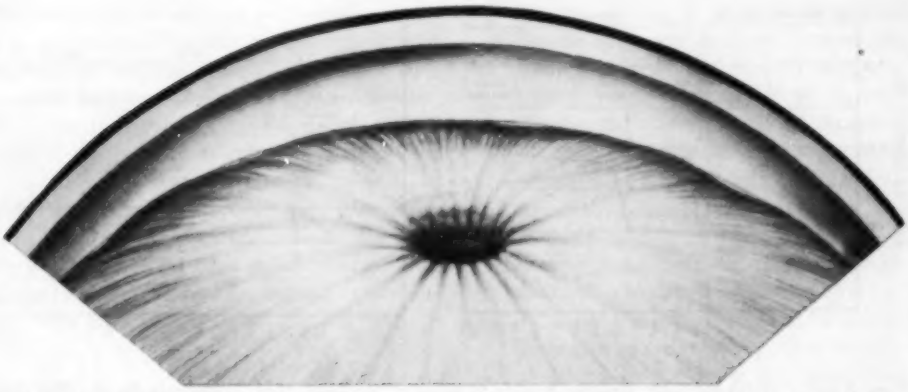

Fig. 1A (Otto Barkan). Narrow-angle glaucoma with shallow axial depth of the anterior chamber. Preoperative gonioscopic view in the 6-o'clock meridian. The entrance to the angle is narrowed to a slit by the bombé of the iris. In places, the contour of the iris hides the line of Schwalbe. Closure of the angle is the result of the iris contacting the ring of Schwalbe.

widens the angle and deepens the peripheral chamber in the same sector.

4. *In many cases a measurable increase in the axial depth of the anterior chamber (that is, a posterior retroplacement of the lens) was found to occur following iridectomy either immediately or in the course of months.* The occurrence and degree of postoperative deepening appears to be related in part to the previous duration of the condition, that is, to the permanence of the anatomic changes which are associated with the anterior displacement of the lens-zonule diaphragm. The axial deepening further decreases the seclusion and widens the angle. It, thus, helps to break through the vicious circle of increased seclusion, iris bombé, narrowing and closure of the angle.[28, 39, 40, 42] (Figs. 2 and 3 show the effect of iridectomy on axial depth of the anterior chamber.)

2. *In all cases the pressure-reducing effects of iridectomy appeared to parallel the extent and degree of the mechanical opening of the angle.* It appears unlikely, therefore, that

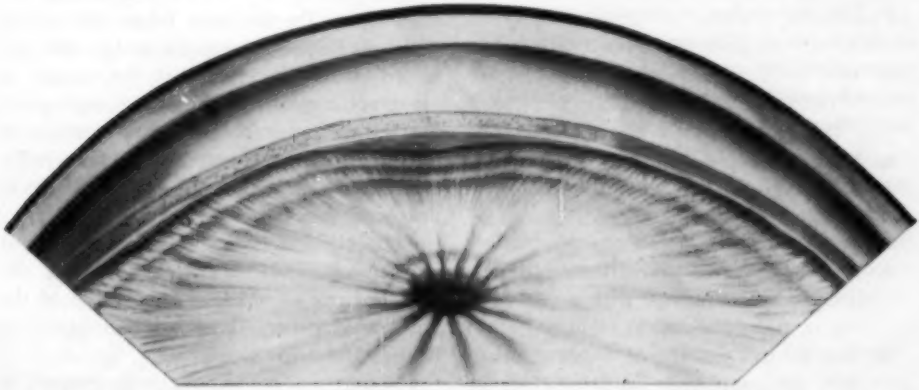

Fig. 1B (Otto Barkan). Postoperative gonioscopic view in the 6-o'clock meridian following peripheral iridectomy in the 12-o'clock meridian shows collapse of the iris bombé and widening of the angle. Aqueous is given access to the angle wall. The white line represents the scleral spur.

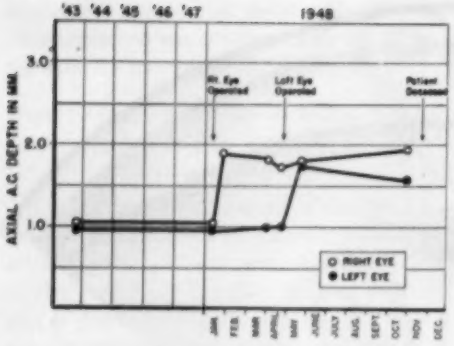

Fig. 2

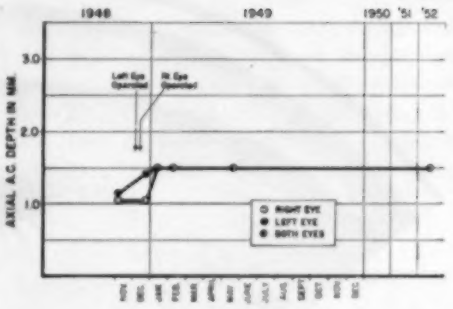

Fig. 3

Figs. 2 and 3 (Otto Barkan). Graphs showing increase of the axial depth of the anterior chamber following peripheral iridectomy performed through a self-sealing keratome incision.

iridectomy acts via interruption of nerve reflexes except to a minor degree as mentioned in the foregoing in connection with excision of the dilator and collapse of the bombé which relieves kinking of the iris in the angle. As a result of straightening the iris where it is bent or pinched near the angle, circulation in its radial vessels is evidently improved.[39,84] Excision of the iris tissue itself appears to have no effect on the pressure. It appears to act mainly by means of increased access for aqueous to the trabeculum and possibly by reduction of reflex stimulation to production of fluid consequent upon straightening of the iris and reduction of the pressure.

3. *The trabeculum is normally permeable in narrow-angle glaucoma until contacts between it and the root of the iris occur which are sufficient to reduce its permeability.* This was indicated by:

a. Its gonioscopic appearance.
b. The reduction of pressure to normal preoperatively after opening the angle by miotics.
c. The reduction of pressure by adequate iridectomy performed with a self-sealing or tightly sealed incision.
d. The normal facility of outflow measured tonographically in those cases in which the angle is open and aqueous has free access to the trabeculum.

4. *Peripheral iridectomy prevents the occurrence of an acute attack but, in some cases, the pressure may rise temporarily during periods of particular stress,* such as pneumonia, influenza, or instillation of adrenalin 1:100 or other mydriatics.

5. *Miotics become markedly more effective following adequate peripheral iridectomy.* The reason for their increased effectiveness apart from the vascular action that they may exert appears to be that iridectomy reduces the pressure in the posterior chamber relative to that in the anterior chamber and relieves the stretching of the iris. As a result, the load of the sphincter is decreased and it is better able to exert its power[39] to keep the angle open. By the same token, the ciliary muscle is helped to keep the trabeculum unfolded. It is suggested that the change in topographic relationships in the angle postoperatively and in the form and position of the ciliary body also exert a beneficial influence on the action of the ciliary muscle in unfolding the trabeculum.

Thus, the action of iridectomy consists of interrupting and sometimes reversing the vicious circle of shallow axial depth of the anterior chamber, increased seclusion, iris bombé, and angle closure.

Pressure was not completely normalized by peripheral iridectomy in a number of cases in this series and it was necessary to continue

the use of mild miotics, or perform a secondary operation. *That the pressure was not normalized without the use of miotics, appears to have been due to one of two reasons:* (a) The formation of adhesions which results if the incision is not immediately and completely self-sealing or tightly closed or (b) the permeability of the trabeculum had been reduced either by previous contacts with the iris or perhaps by the influence of the changed configuration of the ciliary body on the angle mechanism.

Incomplete action of iridectomy

1. *Ineffectiveness of iridectomy in the past can be shown to have been due to:*

a. *The improper selection of cases.* That is, iridectomy was performed in open-angle glaucoma in which it can have no effect except by means of accidental external fistualization or in narrow-angle glaucoma in the presence of extensive adhesions in the angle or of postcontact trabecular changes.

b. *Techniques which resulted in delayed reformation of the anterior chamber and in peripheral adhesions,* that is, scleral incisions which were not completely closed or corneal incisions which were not sufficiently beveled to be completely self-sealing.

Peripheral iridectomy performed through any incision which is not immediately and completely sealed is prone to result in pupillary and/or angle adhesions. Under these circumstances mydriatics used to prevent the formation of pupillary adhesions encourage the formation of adhesions in the angle; miotics which are used to keep the angle open encourage formation of pupillary adhesions. Normalization of pressure then may become dependent on the accidental development of an external fistula. This occurs in 10 percent of all cases in which the incision is placed in the sclera near the root of the iris, ab externo, or by a peripherally placed Graefe keratome incision. Gonioscopic studies showed that the partial and poor results which followed methods employing the above-mentioned incisions were usually the result of peripheral adhesions and closure of the angle subsequent to delayed reformation of the chamber.

c. *Lack of basality of the coloboma which diminishes the angle-widening effect of iridectomy.* A tag of iris left behind in the region of the coloboma, or adhesions of pillars in the angle, are important elements of obstruction only in those cases in which a large part of the remaining angle is obstructed.

Secondary pigment band and secondary trabecular sclerosis

As a result of the collapse of the bombé and widening of the angle following iridectomy, the gonioscopic observer (by lowering his line of vision to the flattened plane of the iris) is able to obtain a more vertical view of the angle wall. This increased verticality makes it possible for him to see details and structures impossible to distinguish preoperatively because of foreshortening of the angle wall.

Thus, a well-defined trabecular pigment band was observed in many cases postoperatively in locations in which it could not be seen preoperatively because of the oblique line of vision necessitated by the iris bombé.[39,53] This pigment band occurred only in those locations where the iris had previously been in contact with the angle wall (figs. 4A and 4B). I have designated it a "secondary" pigment band to distinguish it from the one which is characteristic of and occurs primarily without previous contact with the iris in open- (wide) angle glaucoma.[28,53,58,59]

The gonioscopic appearance of the secondary pigment band corresponds to the anatomic findings of Levinsohn[35] and Verhoeff[36] which showed in histologic sections that pe-

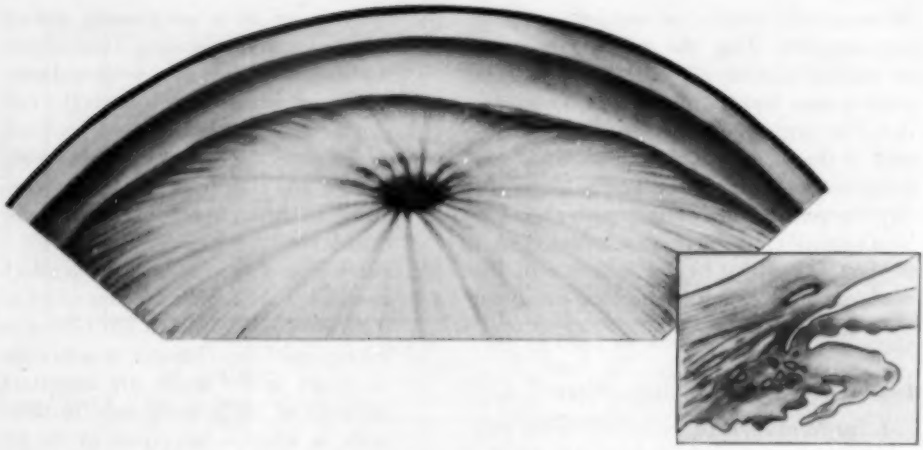

Fig. 4A (Otto Barkan). Narrow-angle glaucoma with shallow axial depth of the anterior chamber. Preoperative gonioscopic view in the 12-o'clock meridian. Note the secondary trabecular pigment band at the 1- and 2-o'clock positions where the wall is exposed by depressions of the bombé.

ripheral adhesions of the iris result in impregnation of the trabeculum with pigment and in matting or sclerosis of the trabeculae.

That this pigment band and the trabecular sclerosis were related to reduced permeability of the trabeculum was borne out by the more frequent need of postoperative miotics to maintain normalization. It was proved in one case in which iridectomy had reduced pressure by 20 mm. but failed to normalize it completely. Bisection of the pigment band and partial removal of it by trabeculotomy reduced the tension another 22 mm. to normal (fig. 6). Normalization of the pressure in this eye has been maintained without miotics since operation up to the present time, a period of three and a half years.

It is not implied that impregnation with pigment per se necessarily constitutes the obstruction. It does, however, appear to be in-

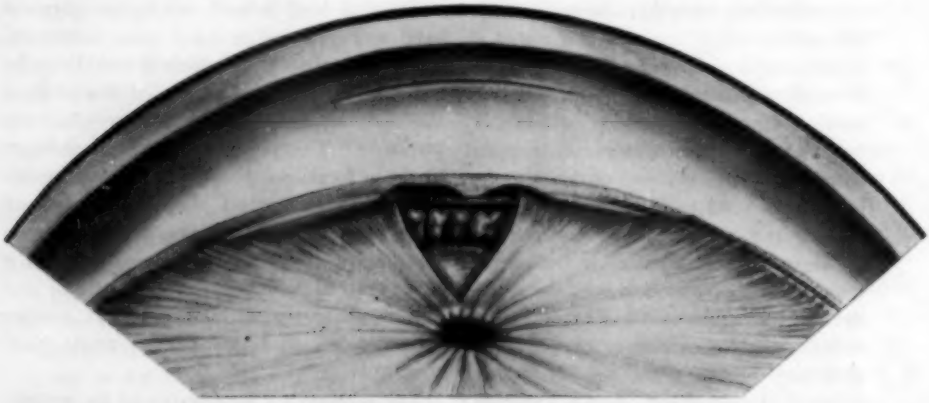

Fig. 4B (Otto Barkan). Postoperative gonioscopic view in the 12-o'clock meridian. The iris has remained adherent at the 11-o'clock meridian and between the 1- and 2-o'clock positions where the bombé had been most marked preoperatively. A secondary trabecular pigment band was present in adjacent areas, the result of previous contact between iris and trabeculum. Note axial position of inner corneal wound lip.

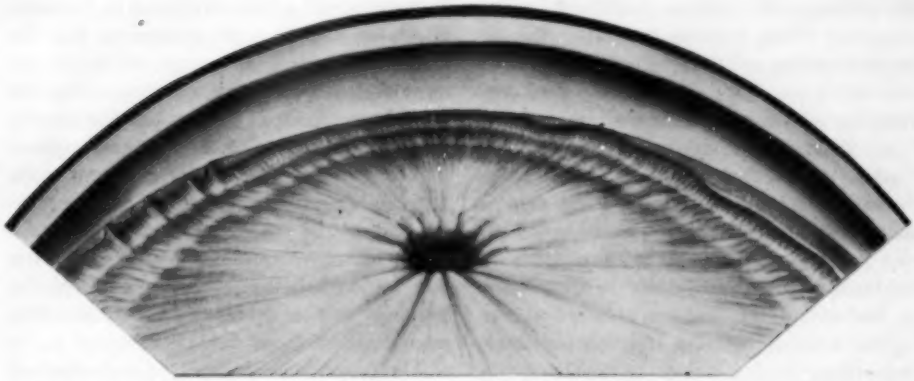

Fig. 5 (Otto Barkan). Narrow-angle glaucoma with normal axial depth of the anterior chamber. Preoperative gonioscopic view shows the angle partially closed by the last fold of iris contacting and advancing up the angle wall rather than by closing it by the bombé contacting the line of Schwalbe as in Figure 1A.

dicative of an obstruction of or associated with a sclerosis of the trabeculum.[53, 58, 59] The presence of trabecular sclerosis associated with a secondary pigment band appears to explain many cases of incomplete reduction of pressure following iridectomy for narrow-angle glaucoma and the need in some of them for the continued use of miotics or for further surgery.

It has been stated that iridectomy may convert a "congestive" glaucoma into a chronic "simple" one. This is explained by

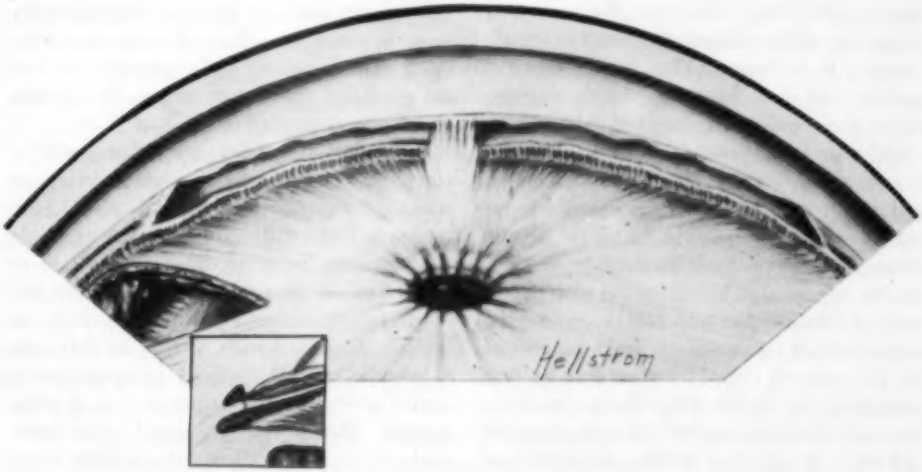

Fig. 6 (Otto Barkan). Postoperative gonioscopic view of a case of narrow-angle glaucoma with shallow axial depth of the anterior chamber showing collapse of bombé of the iris and widening of the angle following peripheral iridectomy. The preoperative view was similar to that shown in Figure 4A. The pressure was reduced but not normalized by the iridectomy. A trabeculotomy which bisected the pigment band from the 1- to 5-o'clock positions reduced the pressure to normal. At the 3-o'clock position an adhesion of the stroma of the iris has formed. The root of the iris is intact and there is no sign of a supraciliary cleft. The inset is designed to show the absence of communication with the suprachoroidal space.

the gonioscopic findings described in the foregoing which indicate that, after the increased tension and the congestion have been relieved by opening the angle, decreased permeability of the trabecular mechanism, that is, a condition of open-angle glaucoma, may remain or as the result of delayed reformation of the anterior chamber a permanent trabecular block may be added. This view is supported by the measurements of Goldmann[36, 49] who found that in many cases of iridectomy the tension remains at the higher limits of normal and the resistance to outflow is not normalized. The tonographic measurements made by me likewise indicate in these cases that the facility of outflow is reduced in the presence of an open angle.

Relation of the axial depth of anterior chamber and of corneal diameter to action of iridectomy

Increased seclusion and the narrow-angle mechanism are usually related to a small corneal diameter and shallow axial depth of the anterior chamber.[30] However, the angle may be narrow and predisposed to close in the absence of these factors. Thus, some cases (20 percent) of noncongestive chronic narrow-angle glaucoma were observed which were associated with normal corneal diameter, normal axial depth of the anterior chamber, and a degree of bombé of the iris which appeared gonioscopically to be only slightly greater than physiologic. In these latter cases the iris appeared to be redundant with rather marked furrows and with folds crowding the angle, the last fold closing it from the root of the iris upward (fig. 5) rather than by first contacting the line of Schwalbe as occurs in the cases showing a marked bombé (figs. 1A and 4A). Whether or not the iris is disproportionately large in these cases or there is a change in secretion is a matter for speculation. The fact is that they also reacted favorably to iridectomy. This indicates that in them also a pupillary block (increased seclusion) was a pathogenic factor.

It was striking in several cases of the acute attack in narrow-angle glaucoma, that the corneal diameters and axial depth of the anterior chamber were average while the bombé was marked. The explanation may be that sudden closure of the angle throughout its circumference locked the aqueous in the anterior chamber. As a result of this, anterior displacement of the lens could not take place. In some cases, the bombé of the iris was so marked that the iris contacted the posterior corneal surface more than two mm. axial to the line of Schwalbe.

The occurrence of increased seclusion and iris bombé in the presence of an average size cornea and axial anterior chamber depth poses the question of what other factors may be involved in their production. The consideration of these factors whether physicochemical, secretory, or anatomic is purely speculative at this time and must be the subject of future investigations.

Discussion

The study of the action of iridectomy was carried out both in chronic noncongestive cases in which the effects of congestion, vascular strangulation, and transudation had not confused the picture and in the chronic and acute congestive phases.

Following iridectomy performed with a completely sealed incision (irrespective of which of the two techniques is used), the tendency to formation of pupillary or angle adhesions in the noncongestive phase is so slight that the postoperative use of both miotics and mydriatics may, in most cases, be entirely dispensed with. It may be sufficient to use the natural tendency to mydriasis to insure against the formation of posterior adhesions. However, if the pupil, which was made miotic at operation, did not dilate spontaneously and react actively to light in 24 hours, a drop of a mild mydriatic (euphthalmine, two percent, or adrenalin 1:100) was instilled in order to obtain transitory mydriasis. When the pupil was dilated to a diameter of about four mm. it was permitted to

contract or was contracted again by a miotic of such strength as merely to counteract the mydriatic. This process was repeated as long as there was any tendency toward the formation of adhesions. This has rarely been necessary since the very small sealed incision ab externo has been used.

In many noncongestive narrow-angle glaucomas, following iridectomy, patches of pigment were observed on the angle wall after it had become exposed to view by collapse of the bombé. It was distributed in the shape of an irregular ring or band. It was absent in those places where no previous contact had taken place. The pigment was evidently the result of previous contacts between iris and angle wall without organic adhesions having formed. Associated with this "secondary pigment band"[20, 53] the angle wall also showed relative impermeability to light suggesting trabecular sclerosis. These changes indicate reduced permeability to fluids since tonography showed reduced facility of outflow in the presence of an open-angle. Thus, the present investigations show that not only adhesions in the angle but also damage to the trabeculum, the result of previous contact with the iris, in the presence of an open angle may account for the incomplete action or failure of iridectomy in many cases.

The obstruction in the trabeculum also reduced the effectivity of miotics. Occasionally the trabecular obstruction was of such degree that the tension could not be controlled by miotics. It is theoretically possible that the diminished effectivity of miotics was also in part the result of reduced action of the ciliary muscle in unfolding the trabeculum due to the changed topographic conditions in the angle in narrow-angle glaucoma.[20]

For these reasons iridectomy was not as effective in these cases as it was earlier in the disease. It was striking in how large a percentage of cases early in the course of noncongestive narrow-angle glaucoma transient contacts between iris root and trabeculum had already occurred and damaged the trabeculum. This accounts for the frequent need of miotics postoperatively to normalize the pressure completely.

Whether the permeability of the trabeculum has been impaired can be determined preoperatively in many cases by gonioscopy (presence of a trabecular sclerosis, of a secondary pigment band, or of adhesions), by a history of episodes of partial closure of the angle, by the effect of miotics on the pressure, and by tonography.

In early cases of narrow-angle glaucoma in this series in which contact of the root of the iris with the angle wall had not injured the permeability of the trabeculum, iridectomy performed with a sealed sclerocorneal incision ab externo which was no larger than one to 1.5 mm. where it entered the anterior chamber was found to normalize the pressure in all cases.

The importance in narrow-angle glaucoma of early or prophylactic operation with peripheral iridectomy performed with a completely sealed small ab externo incision cannot be overemphasized. It is especially valuable in one-eyed individuals and as an early or prophylactic operation on fellow eyes.

Its effectivity is independent of the degree of tension except insofar as this is related, because of the duration or degree of the glaucoma, to the probability of an impaired condition of the trabeculum following angle wall contacts. Its effectivity is also reduced by prolonged progressive anterior displacement of the lens in noncongestive cases presumably because as the result of the time elapsed the derangement has become more permanent and less reversible than it is in the congestive cases which come to operation early in their course.

In cases of long-standing increasing anterior displacement of the lens in which the tension is uncontrolled and in cases in which the first eye developed a malignant course iridectomy may be combined with aspiration of vitreous and deepening of the anterior chamber.[42] If it is not immediately effective prompt extraction of the lens in the capsule is indicated. Further experience may show

that in this type of case initial extraction of the lens in the capsule is preferable as recently emphasized by Chandler.[63]

In cases of this type another hypothetical factor must be considered, for example, that the zonular anterior hyaloid diaphragm is relatively impermeable to passage of fluid from behind forward. Nordenson[66] called attention to this possibility in perfusion experiments. The malignant course in some cases of narrow-angle and of aphakic glaucoma is suggestive of this.

Peripheral iridectomy ab externo was employed successfully in the early phase of the acute attack in some cases. However, a total broad iridectomy ab externo appears advisable in those cases in which mydriasis persists or in which surgery had been unduly delayed, and there is urgent need of normalization. Total iridectomy gives greater assurance of freeing and excising a wide area of basal iris. Should the angle itself have been insufficiently freed to provide for adequate outflow the ab externo approach encouraged by massage offers a chance in these cases for the development of external fistulization.

The postoperative gonioscopic findings in several successfully normalized cases in which marked congestive symptoms and increased pressure had been present for over two weeks were of particular interest. The angle appeared closed in over two thirds to four fifths of the circumference by adhesion of the iris to the ring of Schwalbe. In the remaining circumference the angle was open and the trabeculum was exposed to aqueous. It appeared that the adhesion was limited to the line of Schwalbe and that the reduced pressure was the result of aqueous flowing behind the adhesion from the open portion into a blind passage, as found in anatomic sections by Elschnig.

In general, and always in the noncongestive phase, the iridectomy was made peripheral, included the root of the iris, and preserved the sphincter for future miotic action as originally advised by Pflüger.[10] A single iridectomy usually was sufficient.

To summarize: In the early stage of narrow-angle glaucoma, both noncongestive and congestive, before adhesions have formed or the trabeculum has been damaged, peripheral iridectomy ab externo with a very small sealed incision is consistently effective in normalizing pressure.

Secondary operations

When iridectomy does not normalize the pressure even with the help of miotics, cyclodialysis, trephining, iridencleisis, or cyclodiathermy may be employed as a secondary operation. I have found, contrary to common belief, that cyclodialysis is equally if not more effective in the presence of adhesions than in their absence.[54, 60] The previous iridectomy, by collapsing the bombé and interrupting the narrow-angle mechanism, is of benefit for the ensuing cyclodialysis.

In monocular cases cyclodialysis is preferred to fistulizing operations (trephining and iridencleisis) as a secondary operation because of its lesser hazards and complications, and because the fistulizing operations are prone to encourage and aggravate the narrow-angle mechanism and the formation of peripheral adhesions.[51]

In the stage in which there are peripheral adhesions iridectomy can be combined with freeing of the adhesions in the angle through the same incision with a blunt instrument as originally suggested by Torok,[60] Jervey,[61] and Wootton,[62] and recently emphasized and practiced by Chandler.[49] In my experience these procedures have no advantage over a cyclodialysis combined with iridectomy.

If the preoperative diagnosis shows the angle to be largely closed by adhesions, the two operations may advantageously be done at one sitting. The cyclodialysis incision is prelaid and peripheral iridectomy ab externo is performed in the same quadrant. The cyclodialysis is then performed by first making the dialysis to either side of the ab externo incision and then completing it in the intervening area from within the chamber. Air

injection stops hemorrhage and reforms the chamber. A small air bubble can be left or replaced by saline solution.

Fistulizing operations appear to be equally indicated in this stage and in the later condition in which there has been prolonged congestion, a large part of the angle is closed, and the axial depth of the chamber is very shallow. Cyclodiathermy can always be added.

In order to avoid the necessity of secondary operations, it is important to operate early in the course of the disease with peripheral iridectomy before permeability of the trabeculum has become impaired and effectiveness of sphincter and ciliary muscle has been reduced, and before the nerve head has been injured enough to predispose it to further loss (excavation to the rim).

Conclusions

In narrow-angle (iris-block) glaucoma in the early stage the specific action of iridectomy consists of collapsing the iris bombé, widening the entrance to the angle throughout the circumference, and preventing postoperative adhesions, thus exposing the trabeculum to aqueous. Iridectomy breaks through the vicious circle of increased seclusion (pupillary block), bombé of the iris, and closure of the angle. In many cases the axial depth of the anterior chamber, measured with the Ulbrich drum and with the method of Linstedt (apparatus of Stenstrom), was found to be increased postoperatively. This retroplacement of the lens helps to break the vicious circle and to reverse the self-aggravating process of narrow-angle glaucoma.

The specific action of iridectomy takes place adequately only when the incision is sealed and preoperative adhesions are absent.

In order to prevent delayed reformation of the anterior chamber and adhesions in the angle and to encourage the specific action of iridectomy, the incision should be completely sealed, sclerocorneal ab externo, very small, and closed by a prelaid suture. It may be made intracorneal, valvelike, and self-sealing. In practice the ab externo technique is preferred because of its simplicity and safety.

In cases where the specific mechanical action of iridectomy was complete, but the pressure was not normalized without the use of miotics, the reason was found to be a "secondary" trabecular pigment band and/or sclerosis of the trabeculum, the results of previous contact between angle wall and root of the iris. In these cases tonographic findings indicated reduced permeability of the trabeculo-Schlemm's canal mechanism in the presence of an open angle. They required the postoperative use of miotics or further surgery (cyclodialysis).

In one such case following incomplete normalization of pressure by iridectomy, a trabeculotomy which bisected the pigment band completed the normalization of pressure without the use of drops. This supports the belief that it was the reduced permeability of the trabeculum which had prevented effective normalization of tension by iridectomy.

Peripheral iridectomy with an ab externo incision, very small and sealed by prelaid sutures, is recommended as an early and as a prophylactic operation. It is consistently effective when performed before permeability of the trabeculum has become impaired or adhesions in the angle have formed. It is safe and not followed by late complications.

It is suggested that external fistulizing operations should be avoided in the early stage of narrow-angle glaucoma because they encourage delayed reformation of the anterior chamber and adhesions in the angle. In some cases they may precipitate a malignant course.

In the late stage of narrow-angle glaucoma in which there is considerable trabecular obstruction or organic closure of the angle, in either the noncongestive or congestive phase, cyclodialysis combined with iridectomy or the fistulizing operations are recommended as initial procedures.

If a malignant course threatens and it is considered that extensive organic adhesions have not formed in the angle, peripheral iridectomy with a very small ab externo incision may first be tried. If not immediately successful in reducing pressure, it should be followed by prompt extraction of the lens in the capsule combined with total iridectomy. Further experience may show that initial extraction of the lens in the capsule combined with total iridectomy is preferable.

Peripheral iridectomy performed with a small sealed ab externo incision is a safe and a consistently effective operation in early narrow-angle glaucoma.

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CLINICAL USE OF ORBITONOMETRY*

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INTRODUCTION

The evolution of our knowledge concerning the etiology of exophthalmos is one of the most interesting chapters in clinical research. In spite of numerous contributions throughout the past several years, the exact etiology is still unknown.

The two most commonly held theories implicate the endocrine system. One theory holds that excessive thyroid hormone (thyroxin) causes protrusion of the eyes, although to a minimal degree. The other theory, and the one that is more widely accepted, implicates the pituitary as the main offender. The latter, by excessive activity, specifically by the anterior lobe, liberates an excess of thyroid-stimulating hormone or thyrotropin. Recently the effects of hypothalamic activity has frequently been alluded to.

In a review of the experimental production of exophthalmos Jefferies[1] came to the conclusion that, although the exophthalmic factor exists in close association with the thyrotropic hormone in the pituitary, it is not this hormone alone that causes the exophthalmos. Other experiments have exonerated the adrenocorticotropic hormone and the follicle-stimulating hormone as being of serious import.

The net result of most of the recent research, while it may point out the association of the various steroid hormones to the production of exophthalmos, does not supply the final answer to this riddle.

It is not the purpose of this paper to analyze or review the puzzling factors which may or may not contribute to the formation of exophthalmos. As ophthalmologists we are concerned with aiding the internist in his diagnosis of exophthalmic thyroid disease. In performing this duty we accept the theory of the thyroid-stimulating hormone and provide some of the means by which a differentiation between the thyrotoxic and the thyrotropic types may be made.

The importance of making this distinction is, of course, due to the serious consequences which result when a mild innocuous protrusion of the eyes develops into a so-called malignant exophthalmos, with the resulting loss of one or both eyes. The internist is usually faced with the problem of a patient who exhibits signs of excessive thyroid activity, mild proptosis, and other systemic symptoms of thyroid disease. The disease entity is not always as clear cut as the usual textbook picture of Graves' disease, and so he must rely on numerous clinical and laboratory tests to reach a decision as to whether to treat his patient by means of thyroid depressants, and perhaps by surgery (of the thyroid), or whether to attack the condition as a hormone problem, in which the thyroid is not primarily at fault. More than one eye has been lost by the injudicious surgery and by inadvertent use of thiouracil and other thyroid-depressant drugs.

In 1944, Mulvaney's[2] monumental treatise on the differentiation between the thyrotoxic and the thyrotropic types made us feel as though we finally had a justifiable and foolproof method of distinguishing between the two. Today, although it appears that Mulvaney's idea may not be entirely correct, his work still serves as an excellent basis for diagnosis, and, until a better one comes along, is, perhaps, the only basis we can go by.

Although the theories of the pathogenesis of the disease may change, the cardinal ocular signs and the pathologic changes in the retro-

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TABLE 1

THE OCULAR SIGNS

Thyrotoxicosis	Thyrotropic Exophthalmos
Lid lag Lid retraction	Gritty sensation in eyes. Lacrimation and photophobia chemosis and conjunctival edema
Stare and tension of musculature about the eyes The proptosis is more apparent than real	True forward displacement of globe (as determined by measure). The proptosis is more real than apparent.
Lids do not bulge, show characteristic folds	Bulging of the lids, especially where the retrobulbar tissue protrudes around the globe
The globe can be easily depressed into the orbit	Resistance when pressure applied to push globe backward
Unusual to have extraocular muscle weakness. No diplopia	Frequent extraocular muscles paresis or paralysis. Frequent diplopia especially of vertically acting muscles

bulbar tissues seem to remain unchanged. Table 1 shows the ocular signs which differentiate the two types.

Unfortunately the differentiation is not quite as clear cut and simple as Table 1 would indicate. Many cases appear to be of the so-called mixed type and some of the signs may very well overlap. The classification of Mann[3] appears to simplify some of the differences (table 2).

Weight loss and so forth, as in Group 2, Table 2, plus proptosis and ophthalmoplegia develop simultaneously. Thyrotoxic signs may respond readily to medical treatment.

The gross and microscopic pathologic changes in the retrobulbar tissue are also characteristic and have been noted innumerable times at post mortem and during decompression surgery.

In cases of thyrotoxicosis, weakness of the musculature is outstanding. Mulvaney[2] has likened the protruding eyeball to the cork in a champagne bottle. When the wires holding the cork are cut, the cork pops out. In like fashion when the recti are weakened, the eyeball pops forward.

The muscles are thin and pale with a degenerative loss of striation and fibrillation. The nerves show a granular degeneration. There is no edema and no round-cell infiltration. The orbital fat is normal.

In contrast, the usual findings in thyrotropic exophthalmos are: The extraocular muscles are thickened and enlarged, some have been found to be the size of a small finger. The eye is, therefore, pushed out instead of being popped out. The muscles show fibrous and round-cell infiltration.

There may, also, be an increase in orbital fat and edema of the orbital contents—the pathologic factors upon which the principle

TABLE 2

CLASSIFICATION ACCORDING TO MANN

GROUP 1
Primary thyroxin deficiency with compensatory excessive thyrotropic hormone
Patients aged 40 years or over
Four times more common in men
Low basal metabolism rate with or without signs of myxedema
Lid and conjunctival edema
Proptosis not reduced by pressure
GROUP 2
Primary excessive thyroxin followed by thyroid failure with subsequent excess of the thyroid-stimulating hormone
Patients aged 40 years and over
Four times more common in men
History of severe emotional shock
Elevated basal metabolism rate
Weight loss and tachycardia
Swelling of lids, chemosis, proptosis, and ophthalmoplegia following spontaneous cure or via thyroidectomy
GROUP 3
Excessive thyroxin and excessive thyroid-stimulating hormone arising simultaneously
Patients about 40 years of age
More men than women
Basal metabolism rate elevated

of orbitonometry is based.

In view of the pathologic differences, it becomes obvious that in the toxic types of thyroid disease, the eyeball can be easily compressed into the socket, whereas, in the tropic cases there will be increased retrobulbar contents and, therefore, inability to compress the eyeball backward.

Orbitonometry

Review

The possibility of measuring the displacement of the eye posteriorly was first mentioned by von Graefe in 1868. This method is described by Birch-Hirschfeld.[4] It consists simply of placing the finger tips on the closed eyelid and forcing the globe back. It is obvious that this method is no more scientific than taking intraocular pressure by tactile means.

The first attempt at measuring the retrobulbar resistance objectively was made in 1910 by Langenhan.[5] In his method, pressure was applied over the closed eyelid and measured. However, because of the small surface contact, many errors were induced. Plegge[6] pointed out many of these inaccuracies, and the method soon fell into disregard.

In 1914, Gutman[7] described an instrument which exerted pressure directly onto the cornea, resembling closely the Schiøtz tonometer. The maximum weight applied was 25 gm. This instrument went through a series of improvements over a span of years and was finally given the name of "piezometer."

In 1931, Plegge[6] devised an instrument which exerted a pressure of 10 gm. This was done by means of a small rod resting on an ordinary Zeiss contact glass. To keep the rod smoothly on top of the convex surface of the glass certainly must have taxed the designer's ingenuity.

In 1942, Georg[8] revealed his new "piezometer" which was comparable to the Bailliart dynamometer. However, a pressure of 500 gm. could be exerted. As far as can be determined, this instrument is practically unheard of in this country.

Copper orbitonometer

The latest and the most ingenious piezometer was introduced by Copper[9] at the meeting of the Ophthalmological Society of the United Kingdom in 1948. Copper had been stimulated in this research by the insistence of Means[10] that "what is really needed to settle these points (differentiating types of ophthalmopathy) is a method of measuring intraorbital pressure. At present (1945) is can only be roughly approximated by palpation."

Copper,[9] therefore, devised what he called the orbitonometer which not only measures the intraorbital pressure but also measures the degree of exophthalmos at the same time.

By careful studies over several years, Copper was able to define normal values and to make interpretations on clinical material. Unlike the older instruments, this apparatus apparently affords an amazing accuracy. (The standard deviation was found to be 0.34 mm. or a 95-percent range of ± 0.7 mm.) When the instrument is used as an exophthalmometer, it compares favorably with the Hertel instrument and is, possibly, more accurate.

The orbitonometer of Copper consists of three parts (fig. 1):

1. The dynamometer (similar to the one of Bailliart).

2. The supporting bridge which rests against the outer orbital margin as does that of the Hertel.

3. The contact shell into which the plunger of the dynamometer is inserted.

The test is performed with the patient in a recumbent position, similar to tonometry. The eye is anesthetized by two instillations of 0.5-percent pontocaine solution. The apparatus is equipped with three sizes of contact shells. The best-fitting shell is applied to the eye and the apparatus is set up as shown in Figure 2.

The degree of exophthalmos is then easily read off the scale on the plunger. This is a direct reading of the height of the apex of the cornea in relation to the lateral orbital

rim. This, of course eliminates the factors of parallax and tilt, as induced by the Hertel instrument, making the Copper measurements more accurate.

The first reading records the proptosis without any pressure applied. The plunger is then compressed to the 100-gm. mark and allowed to remain for three seconds, the plunger is further compressed to the 200-gm. mark for another three seconds, the 300-gm. and the 400-gm. pressures are subsequently applied, each for two seconds. These five readings are plotted on graph paper and form the orbitonometry curve. On the basis of these curves or slopes, Copper[9] differentiates the ophthalmopathies.

It seems appropriate indeed that Means,[8] whose wishes Copper fulfilled, was first in this country to report a series of cases of thyroid exophthalmos from the Massachusetts General Hospital. Means and his associate Stanbury, experts on thyroid diseases, reported 53 patients, some normal and others manifesting ocular signs of Graves' disease. Though no definite conclusions were reached, the authors seemed to verify the findings of Copper in that they found the orbital resistance increased in active ophthalmopathy while in Graves' disease there appeared to be no more apparent resistance than found in the normal orbit.

Since, apparently, there have been no further reports from the United States since Means' article, it seemed advisable to study the possibilities of this instrument further, especially from the viewpoint of the ophthalmologist.

Comment

In the course of this study we did not encounter any ill effects worthy of comment. It may be said, however, that Copper[9] reported 900 measurements and, in only two cases, did he notice initial signs of fainting. He considered these two instances to be due to the bulbo-cardiac reflex. As Copper reported in his study, we also noted a fall in intraocular pressure of from six to eight mm. Hg (Schiøtz).

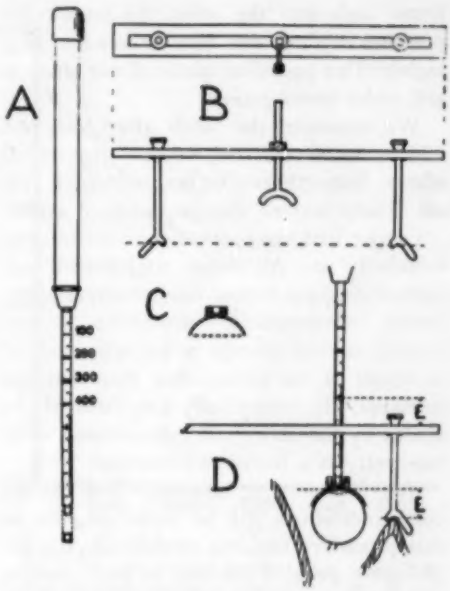

Fig. 1 (Grossmann and Burns). *Design of the orbitonometer.* (A) The dynamometer. (B) The supporting bridge. (C) The contact shell. (D) The figure represents the apparatus in position in commencing the measurement on the right eye of a patient recumbent on the back seen from above. As no pressure is exerted (E) represents the exophthalmometer-value (E-value) which in this case is equal to 12 mm.

At one point during the study we had hoped to correlate the degree of proptosis (actually the degree of retrobulbar pressure) to the degree of intraocular pressure. The number of cases examined was insufficient, however, to warrant reliable conclusions, although one case (J. K.) should be mentioned.

In this case, a constant Schiøtz reading of 28 to 32 mm. Hg was repeatedly obtained. This patient received a complete glaucoma study, including fields of vision, provocative tests, gonioscopy, and tonography. In all instances the findings ruled out the presence of glaucoma. That the bulging tissue from the retrobulbar space did adversely affect the intraocular pressure was repeatedly verified by the fact that, when one of us placed a finger against the orbital margin, upper or lower, thereby compressing the extruding

tissue back into the orbit, the intraocular pressure reading was four to five mm. Hg higher. This particular phase of our study is still under investigation.

We examined the fundi after each test and in no instance did we note any retinal edema, hemorrhages, or occlusion of a vessel. There was no change in visual acuity.

Copper lists the contraindications to orbitonometry as: All active conjunctival and corneal diseases, corneal insensibility, staphylomas, scleromalacia, intraocular hemorrhages, marked vascular retinopathy, and detachment of the retina other than that due to tumor. He categorically states that, if one abides by the above contraindications, orbitonometry is a harmless procedure.

We feel certain, however, that further contraindications will be found as soon as this procedure becomes established. We deliberately avoided the test in high myopes and in those cases in which the retinal periphery had a suspicious appearance.

It would seem logical not to do this test on individuals past 50 years of age who show more than the average degree of retinal arteriosclerosis. It seems inevitable that the compressed globe will sometimes favor occlusion of a retinal blood vessel. We know of no such reports to date, but the literature on this procedure is scarce and no doubt more on this subject will appear in the future.

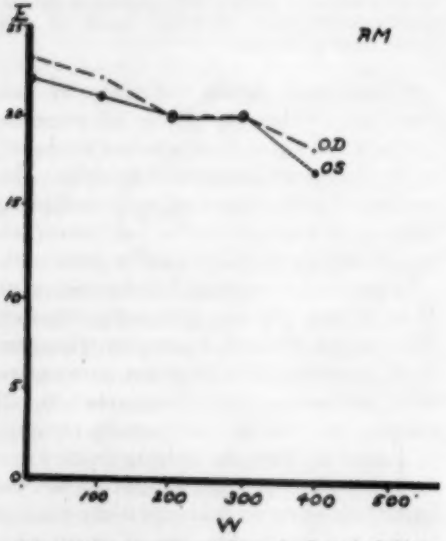

Fig. 2 (Grossmann and Burns). *Case 1.* Orbitonometry showed a somewhat high, flat, and sloping curve.

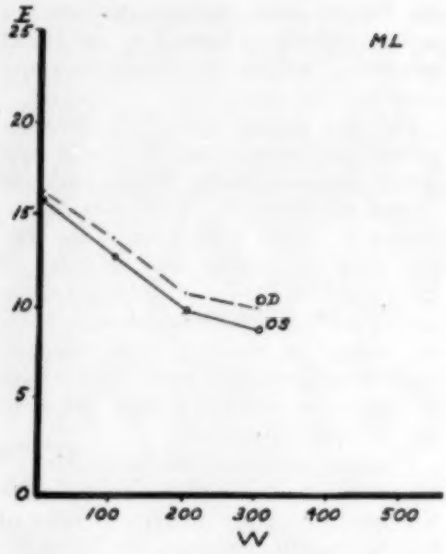

Fig. 3 (Grossmann and Burns). *Case 2.* Orbitonometry revealed an essentially normal curve.

In passing, it is noted that Miles[11] also feels that undue pressure upon the eye may give rise to adverse effects. He quotes Priestly Smith[12] who experimented upon himself. At the age of 40 years, he pressed upon his eye long enough to black out vision. He did note a slight loss of vision as compared to the other eye. When he was 80 years of age, he found himself very nearsighted in that eye and there was a permanent lens opacity in the part of the eye which he pressed. In orbitonometry, however, it is doubted that enough pressure is exerted to affect the visual acuity.

Conclusions

In distinguishing between thyrotoxic and thyrotropic exophthalmos it seems that orbitonometry offers diagnostic evidence, which

may be useful to the internist. Taken alone the orbitonometry findings are insufficient but, when evaluated with clinical and laboratory data, they provide distinct assistance. Furthermore, they help to predict the postoperative course in those cases that go to surgery.

Outside the realm of thyrogenic disease, orbitonometry aids in the differential diagnosis of exophthalmos caused by a space-taking orbital mass.

Last but not least, the instrument measures the degree of proptosis accurately. Its accuracy is as high, if not higher, as the standard instrument, the Hertel exophthalmometer.

Case reports*

Case 1

R. M. (fig. 2) was a 26-year-old white man who entered the hospital on October 3, 1951, because of nervousness and weakness, occasional heat intolerance, and weight loss of 30 pounds. The basal metabolism rate was plus-50 three months prior to admission.

Physical examination revealed many of the classic signs of Graves' disease with marked exophthalmos, lid lag, and infrequent blinking. The basal metabolism rate was plus-62 and cholesterol was 112 mg. percent.

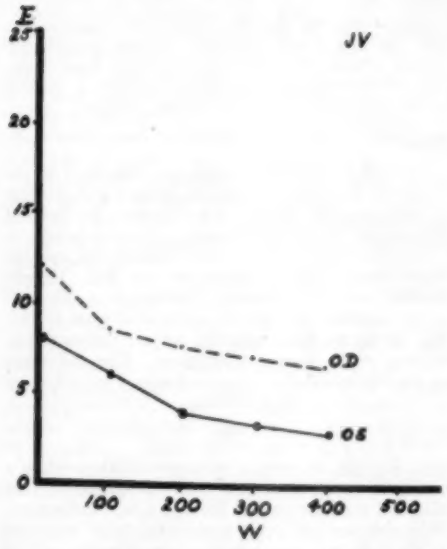

Fig. 4 (Grossmann and Burns). *Case 3.* On the involved left side (lymphoid granuloma) the orbitonometric readings gave a very flat curve.

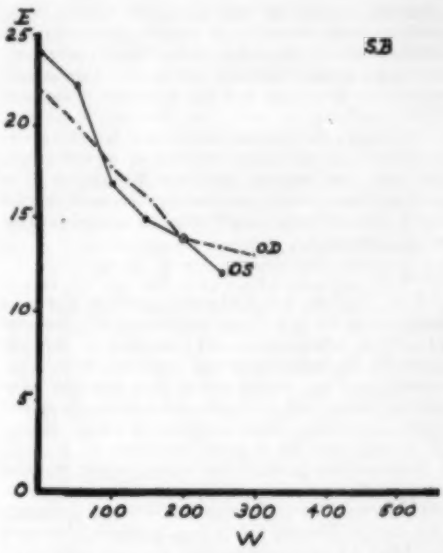

Fig. 5 (Grossmann and Burns). *Case 4.* Orbitonometry readings showed a normal curve which was expected of this patient.

Orbitonometric studies at this time revealed a somewhat high, flat, sloping curve which was not suggestive of Graves' disease. He was placed on a strict preoperative medical course of Lugol's solution and on November 28, 1951, a 90- to 95-percent subtotal thyroidectomy was performed. Repeated orbitonometric readings were somewhat more consistent with the diagnosis of Graves' disease.

Case 2

M. L. (fig. 3), a white man, aged 39 years, was seen in the Eye Clinic with complaints of progressive, painless loss of vision, especially of the left eye. The vision in the right eye was 20/30; left eye 20/400, corrected. Diagnosis was bilateral anterior and posterior capsular cataract. There was a suggestion of mild proptosis. Exophthalmometric measurements were 20/21.

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* We thank Dr. Mark Garry, chief of the medical service, for providing the patients in this report.

Addendum

Since this study was completed, an excellent article on the subject by Kearns[9] and his associates has appeared. It seems fairly certain that Copper's original findings can be duplicated by independent observers. It may become possible, therefore, to anticipate the occurrence of a dangerous exophthalmos prior to surgery. A great deal more study on this subject will be required.

Extensive metabolic and laboratory studies were undertaken to determine, if possible, the underlying etiology of the lens opacities. These studies revealed no positive findings. An uneventful cataract extraction was done and the resultant vision was 20/20.

In review, the medical department felt there was no clinical or laboratory evidence of hyperthyroidism, nor any serious metabolic disturbance. The orbitonometry studies revealed an essentially normal curve. The 400-gm. weight was not applied because of discomfort.

CASE 3

J. V. (fig. 4) was a 62-year-old white man who was seen in the Eye Clinic in August, 1951, because of severe inflammation and drooping of the left lower lid. He had been operated upon one month previously and an orbital tumor was removed. The biopsy report was a chronic granuloma, lymphoid type. The tumor board requested a second biopsy. This confirmed the original diagnosis.

Examination prior to the second biopsy revealed a mass, almond sized, on the infraorbital margin in the midline. The globe was elevated approximately five mm. Following the biopsy, a plastic procedure to reduce the surgical ectropion was undertaken with excellent results.

Orbitonometric readings revealed a very flat curve on the involved side.

CASE 4

S. B. (fig. 5) was a 62-year-old Negro who was seen in the Eye Clinic on a routine examination.

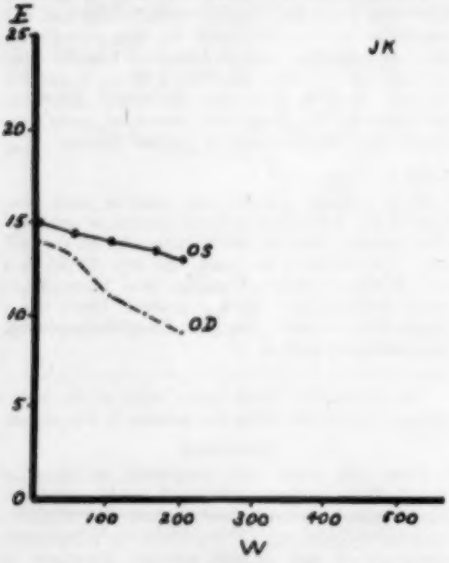

Fig. 6 (Grossmann and Burns). *Case 6.* Orbitonometric studies suggest a thyrotropic type of exophthalmos.

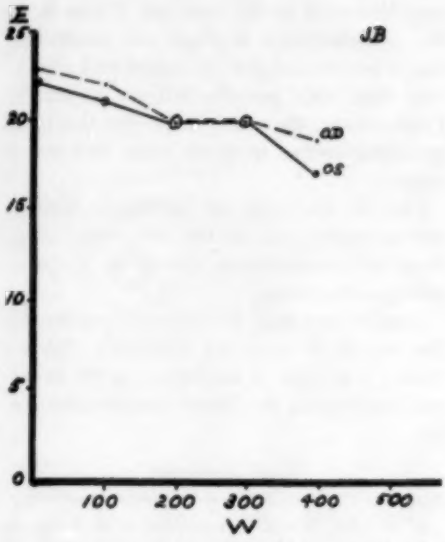

Fig. 7 (Grossmann and Burns). *Case 7.* The orbitonometric readings, although indicating a low-slope curve, were probably normal.

On admission, the chest X-ray film showed changes in the left lung field, compatible with bronchogenic carcinoma. Bronchoscopy and biopsy later proved this.

Ocular examination was essentially negative except for slight exophthalmos. Vision, extraocular muscle examination, fundus, and fields were negative. Orbitonometry readings disclosed a normal curve which was expected of this patient.

CASE 5

J. C., a 37-year-old Negro, was admitted to the Veterans Hospital because of asthma and possible hyperthyroidism. He was referred from the medical department to complete their metabolic work-up.

The eyes and adnexa were negative except for slight exophthalmos, more on the left. Exophthalmos and orbitonometric readings showed a relatively normal curve. It is interesting to note that the Hertel readings and the initial orbitonometric reading were somewhat different. The difference in the Hertel reading was three mm. The difference in orbitonometry was one mm.

CASE 6

J. K. (fig. 6) was a 62-year-old white man, a known diabetic since 1947, who was controlled by diet. He was first seen in the Eye Clinic in October, 1950, because of pressure around both eyes and slight puffiness around both orbits. Tension at first visit was 38/38 mm. Hg (Schiøtz). X-ray studies of both orbits were negative. Diabetes studies revealed occasional trace in the urine with a normal

glucose curve. Studies of the basal metabolism rate were never satisfactory.

In 1947, a subtotal thyroidectomy was performed for hyperthyroidism.

Glaucoma studies revealed a moderate tension and narrow but open angle. The impression was that at least part of the increase in tension was due to forward pressure on the retro-orbital contents.

Orbitonometric studies revealed a flat curve more pronounced on the left eye and suggested a thyrotropic type of exophthalmos.

CASE 7

J. B. (fig. 7) was a 66-year-old white man who was first seen November, 1951, in the Eye Clinic, complaining of blurred near vision. At that time bilateral proptosis was noted, equal in both eyes. The rest of the eye examination was essentially negative. The patient had no specific complaints referable to his eyes. He had been treated previously for arthritis and heart disease.

Orbitonometric readings disclosed a low slope curve, the kind that would be seen in the thyrotropic type of exophthalmos. However, there was no evidence to substantiate this in his general workup and the orbitonometric readings, although indicative of a low-slope curve, were probably normal.

CASE 8

J. L., a white man, aged 34 years, noted sudden blindness while in the Navy in 1944, following a fall into a ship hatch. Right craniotomy revealed a small cyst of the posterior surface of the chiasm. Two years later a bilateral proptosis was noted, associated with loss of weight and nervousness. A thyroidectomy was done elsewhere.

When seen here, no symptoms of thyrotoxicosis were noted. Proptosis, however, persisted. He was placed on thyroid medication. Later, a glucose-tolerance test revealed a diabetic curve, and he was placed on insulin. Eye examination revealed a constant exophthalmos measuring 22 mm. in each eye. There was paralysis of vertical gaze.

Orbitonometry revealed a flat type curve. These readings were repeated three times at yearly intervals, but no change was ever noted, either in the degree of exophthalmos or in the type of compressibility curve.

CASE 9

C. D. was seen as a private patient. The history revealed that, two years prior to this visit, he had toxic symptoms of Graves' disease. He had been treated with Lugol's solution. A year later he was given a massive dose of radioactive iodine. Two months later his eye began to protrude. Another massive dose of radioactive iodine was given.

Following this he complained of diplopia and increased proptosis, and was then referred to one of us (E. E. G.). Examination revealed a bilateral proptosis of 22 mm. in each eye. There was a paresis of the left elevator muscles.

Orbitonometry revealed a low slope curve consistent with the diagnosis of thyrotropic exophthalmos.

This case illustrates the effects of depressing thyroid activity to the point where pituitary action becomes stimulated, no different from a total thyroidectomy. The patient is on thyroid, and by wearing prisms in his glasses, is perfectly comfortable (three diopters vertical prism in each lens).

CASE 10

J. J. was a private patient, aged 41 years. The history reveals that no proptosis existed prior to thyroidectomy in 1951. Two months following surgery, both eyes became violently red and edematous. A severe proptosis was present, and within a few weeks she was unable to see to get around.

When she was seen by one of us (E. E. G.) in 1952, vision was: R.E., counts fingers; L.E., 20/40. Fundus examination revealed a marked optic atrophy in the right eye and moderate in the left eye. The proptosis measured 21 mm. in each eye.

Orbitonometry revealed a very flat curve, consistent with the diagnosis of thyrotropic exophthalmos. She was placed on thyroid therapy by the consulting internist.

CASE 11

E. C., a private patient, aged 48 years, a white woman, was seen complaining of proptosis and tearing and redness of the eyes following thyroidectomy six months previously. Proptosis measured 20 mm. in each eye (Hertel). There were no muscle disorders.

Orbitonometry revealed a low slope curve, consistent with the diagnosis of thyrotropic exophthalmos. Thyroid therapy was advised and in the past three years the patient has been quite comfortable. There is no redness or chemosis of the conjunctiva. The proptosis appears unchanged. The compressibility of the globe appears somewhat increased, thus indicating that the acute phase of malignant exophthalmos has subsided.

CASE 12

S. B., a private patient, aged 38 years, a white woman, was referred to one of us (E. E. G.) because of gradual onset of proptosis in the left eye and diplopia. There were no symptoms or signs of systemic thyrotoxicosis. The exophthalmometric readings (Hertel) were 19 mm. in the right eye and 21 mm. in the left eye. Muscle studies revealed a paresis of the elevator muscles in the left eye. The thyroid was enlarged and the basal metabolism rate was normal on two occasions. Neurologic and metabolic studies were normal.

A thyrotropic disturbance was suspected, but orbitonometric studies revealed a normal compressibility. The consulting endocrinologist felt certain that this was not a case of thyrotropic disturbance. Inasmuch as the patient is still being studied, future events may clarify the diagnosis.

Orbitonometric studies are performed every two months. It may be possible that, in these early cases, compressibility variations are slight and, of course, entirely possible that our normal curves have ruled out the probability of thyrotropic exophthalmos.

CASE 13

T. S., a white man, aged 26 years, was admitted to the hospital in 1951. The diagnosis was lymphosarcoma (reticulum-cell sarcoma). In 1953, he was re-admitted for therapy and it was noted that his left eye protruded. He had noted diplopia for the past two months.

Orbitonometry measurements revealed an exophthalmos of 19 mm. in the right eye and 14 mm. in the left eye. Readings with the weights on the right eye revealed a compressibility to six mm., using the 300-gm. weight. The left eye compressed to only 15 mm., a drop of only four mm. Thus, the two readings afford an excellent comparison study of the effect of an intraorbital mass. This case can be followed to evaluate effects of radiation therapy upon the volumetric mass in the orbit.

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OPHTHALMIC MINIATURE

In case, however, any person's eye projects extremely far forward, of which I have seen many and taken many out, and if it is large, hideous, and detestable, and cannot be covered up or hidden, and the person would be gladly loose and free from this, then I do to him as follows: . . . press the sharp scalpel into a groove under the upper lid, however very close to the bone and on the skull-cap to the very backmost ground, turn then quickly and dexterously the entire eye, especially so that it may be emptied out and made loose on the hinder place in all parts.

Georg Bartisch,
Augendienst, 1583.

A SIMPLIFIED PTOSIS OPERATION*

CHARLES E. ILIFF, M.D.
Baltimore, Maryland

An operation which utilizes the physiologic action of the levator muscle has been considered the ideal procedure in cases of ptosis. Bowman[1] presented his method in 1861 and subsequently Blascovicz,[2] Eversbusch,[3] Berke,[4] and others[5] have employed procedures for shortening the levator to give satisfactory results. The difficult technique of these operations has offered a stumbling block to many surgeons. Poor results have been obtained because of technical difficulties in some potentially successful cases.

The operation here presented shortens the levator and Müller's muscle, thus increasing the primary elevating force to the lid. In addition, the secondary elevating actions of the superior rectus and the levator are enhanced by the resection of the palpebral conjunctiva, which puts stretch on the fibrous attachments from the sheaths of these muscles to the upper cul-de-sac (fig. 1). This secondary action is described by Hildreth[6] and clearly demonstrated in his superb anatomic studies.

The reattachment of the septum orbitale to the advanced levator tendon gives additional support. It is possible that this may increase the secondary action of the frontalis, transmitted through the subcutaneous tissues and orbicularis muscle to the septum orbitale, as postulated by Jameson.[7]

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital. Read at the Wilmer Residents Meeting, March 25, 1953.

OPERATION

General anesthesia is used, ether for chil-

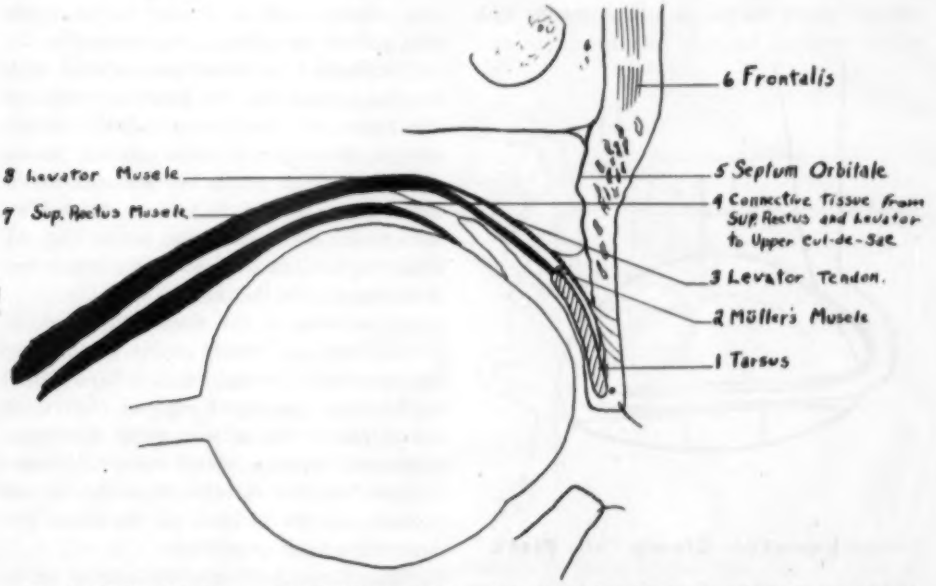

Fig. 1 (Iliff). (1) Tarsus. (2) Müller's smooth muscle connecting levator muscle to upper edge of tarsus. (3) Levator tendon inserting into the lower anterior tarsal surface and into the skin. (4) Connective tissue from sheaths of levator muscle and superior rectus muscle inserting into conjunctiva of upper cul-de-sac. (5) Septum orbitale from periosteum at rim of orbit. (6) Frontalis. (7) Superior-rectus muscle. (8) Levator muscle.

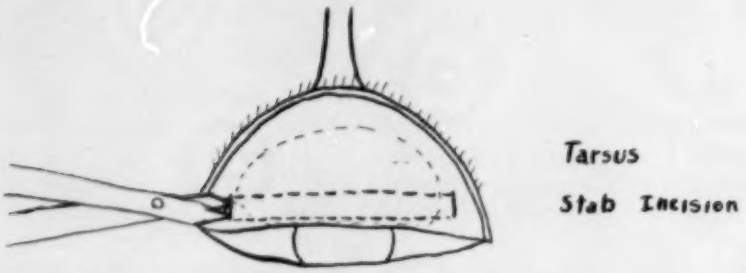

Fig. 2 (Iliff). The lid is everted on a Desmarres retractor, throwing into prominence the superior tarsal edge. Stab incisions are made lateral to the edge of the tarsus into the potential space between tarsus and skin.

dren two to 10 years of age, pentothal sodium for adults. Zephiran (1/1,000) is used for lid and skin preparation.

A few minims of adrenalin are injected beneath the skin along the superior tarsal margin to minimize bleeding. The lid is everted on a Desmarres lid retractor. The everted lid throws into prominence the superior edge of the tarsus.

At the temporal end of this edge and lateral to the tarsus, a stab incision, with straight fine-pointed scissors, is made through the conjunctiva into the potential space between tarsus and skin (fig. 2). One jaw of the levator clamp* is pushed through this incision, across the lid beneath the skin, to the nasal side of the tarsus, where it is brought out through another stab incision in the conjunctiva. The plane of separation is anterior to the tarsal plate, where only mild resistance is met as the clamp separates the fine reflections of the levator tendon to the skin and to the orbicularis muscle (fig. 3).

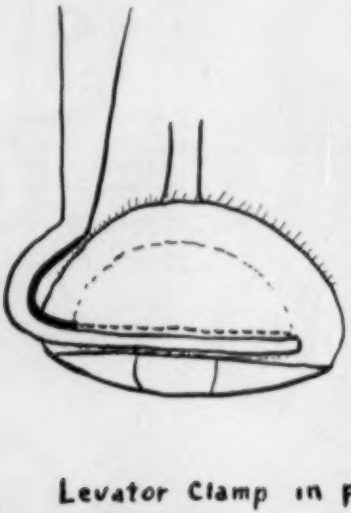

Fig. 3 (Iliff). One jaw of the levator clamp is pushed through the conjunctival incision, across the potential space beneath the skin to the nasal side of the tarsus, and brought out through another stab incision in the conjunctiva.

The clamp is tightened and includes in its bite the conjunctiva, the superior margin of the tarsus to which is attached Müller's muscle, the superior tarsal arcuate vessel, and the levator which lies anterior to the tarsal plate and sends fibrous attachments both to the skin and to the tarsus (fig. 4). Bleeding is minimal as the main artery in this area is caught by the clamp.

An incision of the conjunctiva and approximately two thirds of the thickness of the tarsal plate is made with a Bard Parker knife along the distal edge of the clamp, which places the incision about three mm. from the superior tarsal margin. Stevens scissors are then inserted in the lateral stab wound and the incision of the tarsus and levator tendon is completed.

The clamp, holding conjunctiva, tarsus, Müller's muscle, and tendon of the levator,

* Levator clamp made by the Storz Instrument Company.

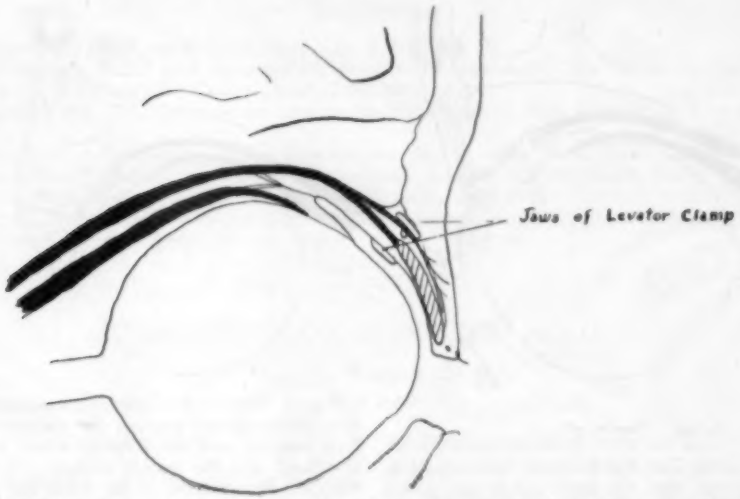

Fig. 4 (Iliff). The jaws of the levator clamp hold (1) the conjunctiva; (2) and superior margin of the tarsus, to which is attached Müller's muscle; (3) the superior tarsal arcuate vessel; and (4) the levator tendon which lies anterior to the tarsal plate and sends fibrous attachments both to skin and tarsus.

is lifted away from the cut everted tarsal plate, exposing fibers of the orbicularis, a few reflected fibers from levator to the skin, the septum orbitale, and the underlying skin. The dissection is extended backward, anterior to the levator tendon and posterior to the septum orbitale, by spreading the blades of the Stevens scissors and by cutting the few reflected fibers to the skin and septum.

The inferior edge of the septum, now freed from the reflections of the levator tendon, is clearly visible as a well-defined plane of tissue viewed from the edge. Anterior to it lies the orbicularis muscle, posterior is the aponeurosis of the levator tendon.

A row of four double-armed sutures (3-0 black silk) is placed 13 mm. from the cut tarsal edge, through all structures held by the clamp. The whole thickness of tissue thus held is excised distal to the suture line.

The sutures are brought forward, taking, as they come, a small bite in the anterior edge of the septum orbitale. They are then passed anterior to the tarsus, and brought out through the skin one mm. behind the cilia line (fig. 5).

This suture placement is extremely important in order to effect an exact reapproximation of the conjunctiva, Müller's muscle, and levator to the cut tarsal edge. The reattachment of the resected levator to the

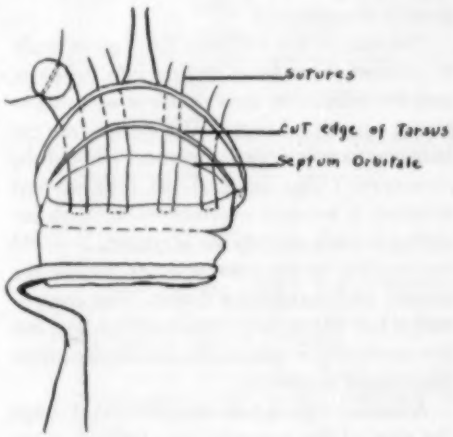

Fig. 5 (Iliff). A row of four double-armed sutures is placed 13 mm. from the cut edge of tarsus, which is held in the clamp, and the whole thickness of tissue is excised distal to the suture line. The sutures take a small bite in the anterior edge of the septum orbitale and then pass anterior to the tarsus and are brought out through the skin, one mm. behind the cilia line.

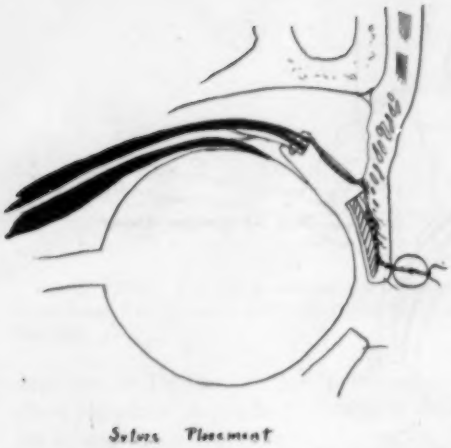

Fig. 6 (Iliff). The double-armed suture starts in the conjunctiva near the upper cul-de-sac, passes through Müller's muscle, the levator tendon, the edge of the septum orbitale, and is brought out through the skin one mm. behind the cilia line.

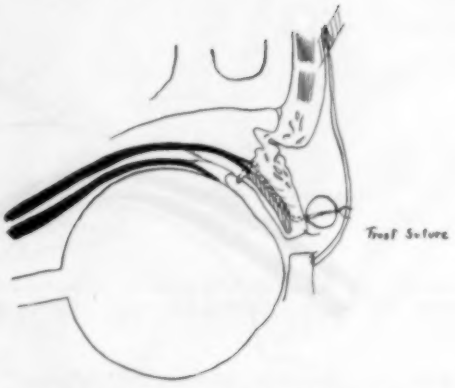

Fig. 7 (Iliff). The original relationships have been re-established between the conjunctiva, Müller's muscle, and the levator, which have been shortened, and the septum orbitale and tarsus. A modified Frost suture in the lower lid, placed on tension to adhesive on the forehead, gives adequate corneal coverage and aids in producing a smooth lid curve.

anterior edge of the septum orbitale, which has not been resected, re-establishes the original relationship of these structures (fig. 6). Since the septum has not been shortened, no checking action to the lid on downward gaze is encountered.

The sutures are tied over small glass beads to prevent them from cutting into the skin, and the tension on each suture is adjusted to give a smooth lid curve. The sutures are cut long in case any readjustment should be necessary. (That is, if at the time of first dressing a marked overcorrection, with inability to close the lid, has occurred, it would be possible under anesthesia to loosen the sutures and correct the defect. This complication has not been encountered to date, but the possibility explains the use of silk rather than catgut sutures.)

A tension suture (modified Frost) through the skin of the lower lid to adhesive on the forehead gives adequate corneal coverage for the first 24 hours, and aids in producing a smooth lid curve (fig. 7). The eye is dressed with antibiotic ointment and an eyepad. The patient is discharged from the hospital in 24 hours, at which time the lower lid suture (Frost) is removed and the eye permitted to remain uncovered. The sutures in the upper lid are removed on the fifth postoperative day. The lid edema has usually disappeared in two weeks, and full effect of the operation is apparent in five to six weeks.

Summary

This procedure shortens conjunctiva, Müller's muscle, and the levator tendon, and re-establishes the filamentous attachments to the septum orbitale without disturbing the anatomic relations of these structures. It is recommended for cases in which any small amount of levator action can be demonstrated, and is justified as a first operation in many instances in which no such function is apparent, since possible failure would not interfere with a later procedure using the frontalis or the superior rectus muscle.

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HYDROCORTISONE IN OPHTHALMOLOGY*

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Introduction

Hydrocortisone (17-hydroxycorticosterone, Kendall's Compound F) is the most recent of the adrenal cortical steroids to be employed in the therapy of ocular disease. Apparently this is one of the principal secretions of the adrenal cortex, which in turn rapidly breaks down into cortisone, in the body. It is obvious that a comparison of its use with that of cortisone, in similar conditions, would be of great interest to the ophthalmologist.

This paper is based upon experiences in 152 cases†; a series of cases of night-blinding diseases (retinitis pigmentosa and associated conditions) is not included in this paper because the results are neither dramatic nor conclusive. As has been pointed out in the past, results of treatment in these conditions are difficult to evaluate unless these results are dramatic or clean cut.

Method of employment

Preparations which have been employed in this work are hydrocortisone acetate and the free-alcohol form of hydrocortisone as well as a combination of both the acetate and the free-alcohol form. The dosage and modes of employment of these preparations are listed in Table 1.

The indications for the use of these preparations are any inflammatory or allergic conditions involving the eye or its adnexa with the possible exception of certain virus or tuberculous infections (for example,

TABLE 1

HYDROCORTISONE DOSAGE

I.	Topical administration
	a. Suspensions of 0.5% and 2.5%—one drop 3 to 6 times daily
	b. 1.5% ointment—two to three times daily
	c. 1.5% ointment* with Bacitracin—two to three times daily
II.	Subconjunctival Administration
	a. Free-alcohol form
	b. Acetate suspension
	c. Combination of free alcohol form and acetate
	All are 25 mg./cc. Use ¼ to ½ cc., preferably of combined form. Free-alcohol form effective 3 to 4 days. Combined form 10 to 21 days. Acetate only is relatively inefficient
III.	Systemic Administration
	a. Oral tablets—25 mg. each. Initial dose 100 to 125 mgm. daily—rapidly decreased as disease responds. Increased if failure to respond
	b. Intramuscular injections—same preparations as used subconjunctivally. Initial dose 100 mg. daily. Rapidly decreased as disease responds. Increased if fails to respond. Single daily dose usually suffices. Initially may divide daily dose into two injections

* Now available in combination with a variety of antibiotics.

* From the Department of Surgery (Ophthalmology), Cornell University Medical College, New York Hospital. The hydrocortisone used was supplied through the courtesy of Dr. Elmer F. Alpert of Merck & Company.

† In some of which more than one form of this therapy was used.

TABLE 2

HYDROCORTISONE ACETATE (TOPICAL)

Diagnosis	No. Cases	Successful	Failures
Optic neuritis	1	—	1
Primary glaucoma	1	—	1
Localized lid allergies	10	9	1
Bullous keratitis	4	—	4
Conjunctivitis, non-catarrhal	10	8	2
Anterior uveitis	9	5	4
Generalized uveitis	3	—	3
Choroiditis	2	—	2
Diabetic retinopathy	4	—	4
Vernal conjunctivitis	7	6	1
Prevernal conjunctivitis	6	6	—
Herpes simplex	1	—	1
Epidemic keratoconjunctivitis	1	—	1
Uveitis associated with Boeck's sarcoid	1	—	1
Keratitis:	6	5	1 (nonspecific)
1 Interstitial			
1 Rosacea			
1 Filiform			
1 Superficial punctate			
2 Nonspecific			
Endothelial and epithelial dystrophy	2	—	2
Striate keratitis	5	2	3
Postoperative granulation tissue	1	1	—
Macular degeneration	3	—	3
Episcleritis	3	3	—

herpes simplex). It is obvious that there is no justification for substituting a new preparation for an older well-tried one unless it can be demonstrated to be more efficient.

I have attempted to study any differences which might exist between cortisone and hydrocortisone in clinical practice. The compounds could not be used upon the same patient, in most instances, for obvious reasons. Since cold figures do not indicate the similarity or disparity between cases listed under the same disease categories on charts, certain observations and conclusions must be based upon mental comparisons of a large series of cases treated with cortisone over the past two and one-half years and the more recent, smaller series, treated with hydrocortisone during the past year.

The first material provided was a suspension of 17-hydroxycorticosterone in 1:5,000 aqueous zephiran chloride. This was utilized in 0.5-percent and 2.5-percent concentrations, as an eye drop and by subconjunctival injection. Later, the 2.5-percent saline suspension provided for intramuscular injection replaced the above for subconjunctival use.

Two ointments in a petrolatum base, one containing 15 mg. per gm. of the acetate and a second, later preparation, containing the same amount of the free-alcohol form, were employed for topical use to supplement the eye drops.

The topical applications were found to be as rapid in action as cortisone and more effective clinically. There was the same dramatic effect upon allergic and other local reactive responses. Edema and inflammatory reactions responded quickly, as a rule. No clinical evidence of appreciable delays in healing was noted.

ILLUSTRATIVE CASES

Nothing will be gained by enumerating those therapeutic virtues of hydrocortisone which are already known to be possessed by cortisone. Hydrocortisone exhibited the ability to dissipate inflammatory and allergic reactions rapidly. It also possesses the power to impart ocular analgesia, similar to that exhibited by cortisone.

It was my impression that those patients already well controlled with cortisone did

TABLE 3

HYDROCORTISONE FREE ALCOHOL (SUBCONJUNCTIVAL)

Diagnosis	No. Cases	Successful	Failures
Keratitis with neovascularization	1	1	—
Eales' disease	1	—	1
Boeck's sarcoid uveitis	1	1	—
Boeck's sarcoid keratitis	1	1	—
Generalized uveitis in erythema nodosa	1	—	1
Central serous retinopathy	1	1	—
Acute choroiditis	6	4	2
Circinate retinopathy	1	—	1
Vitreous hemorrhage (etiology unknown)	2	—	2
Diabetic retinopathy	5	—	5
Angioid streaks	2	—	2
Chronic uveitis	8	6	2
Acute anterior uveitis	2	2	—

TABLE 4

HYDROCORTISONE ACETATE (SUBCONJUNCTIVAL)

Diagnosis	No. Cases	Successful	Failures	Remarks
Boeck's sarcoid uveitis	1	—	1	Better response to combined form
Posterior uveitis	5	1	4	Responded to either combined or systemic form
Generalized uveitis	3	—	3	Responded to either combined or systemic form
Optic neuritis	1	—	1	Responded to high potency corticotropin
Keratitis associated with Boeck's sarcoid	1	—	1	Responded to combined form
Hemorrhages in Eales' disease	1	—	1	—
Diabetic retinopathy	3	—	3	—

better on hydrocortisone. In some cases, it succeeded where cortisone had failed. For example, three cases of chronic generalized uveitis, which were controlled with topical cortisone but exhibited a plus to a two-plus beam and a few cells in the anterior chamber, exhibited less anterior-chamber reaction when topical hydrocortisone was employed.

Two cases of severe vernal catarrh seemed to illustrate the therapeutic difference dramatically:

One of these that of a boy, aged nine years, required 75 mg. of cortisone a day, orally, as well as frequent topical applications of the drops and ointments in order to obtain complete symptomatic relief. The same result was accomplished with hydrocortisone topically, and the patient is now in his second year of treatment with that preparation.

The other patient was a boy, aged eight and one-half years. He has as severe a case of vernal catarrh as I have ever seen. He had been subjected to beta radiation previously elsewhere, as well as to cortisone topically and systemically, without relief. He required barbituates at night in order to sleep. During 1951 and the early part of 1952, he did very well on topical applications of hydrocortisone. During the summer of 1952, the topical applications alone failed to give sufficient relief. The addition of oral tablets of the free-alcohol form in doses of 25 to 50 mg. daily (usually only 25 mg. at night) gives him satisfactory improvement.

During the work with cortisone and hydrocortisone, a number of cases, mostly in young people, have been seen in which the symptoms were similar to those of patients afflicted with vernal catarrh without the gross obvious conjunctival reactions. The symptoms are exaggerated by heat, wind, dust, and brilliant sunlight. They have done well on cortisone. Two of this group who were difficult to control with cortisone have done remarkably well on hydrocortisone topically.

A single case of dendritic keratitis (herpes simplex) progressed rapidly despite five days of treatment with 2.5-percent hydrocortisone topically. This parallels results seen previously with cortisone in some cases of herpes-simplex keratitis. A similar poor result occurred in a patient with epidemic keratoconjunctivitis.

As with cortisone, hydrocortisone, when used topically, was found most effective in the treatment of purely external conditions; its effectivity decreases when one attempts to treat intraocular conditions. While there are cases of uveitis which can be controlled with topical medication, it is not wise to give such therapy a trial of more than several days. If appreciable evidence of a response is not exhibited within that period, other means must be used.

Intraocular disease responds more rapidly to the subconjunctival or systemic routes than to topical therapy, as is the case with cortisone. The effects of subconjunctival

TABLE 5

HYDROCORTISONE COMBINATION OF FREE-ALCOHOL AND ACETATE FORMS (SUBCONJUNCTIVAL)

Diagnosis	No. Cases	Successful	Failures
Choroiditis	6	4	2
Diabetic retinopathy	2	—	2
Generalized uveitis	5	4	1
Keratitis (nonspecific)	3	3	—
Optic neuritis	2	—	2
Macular degeneration	3	—	3
Anterior uveitis	3	3	—
Vitreous hemorrhage	2	—	2
Optic atrophy	1	—	1

injections of the acetate were not very impressive. Crystals were found in situ more than one month after injections of one-third to one-half cc. of the 2.5-percent suspension of the acetate. Incidentally, as with cortisone, continued presence of the crystals in the subconjunctival sac does not imply continued steroid activity at a clinically beneficial level.

Clinically, the material was found to act slowly and at times the impression was gained that the disease got out of control because the acetate did not function with sufficient rapidity. It acted much less rapidly and efficiently than cortisone.

The solubility of hydrocortisone in plasma is approximately one seventh of that of cortisone acetate. At the same time, the hydrocortisone injections created less local reaction than did cortisone.

Because it was felt that a more rapidly acting material was needed, the free-alcohol form of cortisone was then utilized in the subconjunctival injections. This was absorbed within a matter of hours, although it left a pink, indurated area for several days to a week or more. The action was very rapid, effective, and transient, lasting only several days as measured by the clinical response.

It was felt that the use of the hydrocortisone acetate had some beneficial effect, which was not fully exploited because of its slow but prolonged action. At the same time, the rapid activity of the free-alcohol form was impressive; with its period of activity too brief in most instances.

It was decided to investigate a combination of the two forms. This, then, formed the third phase of investigation of the clinical effects of subconjunctival therapy with hydrocortisone. Although the series on the combined preparation is not as yet, a large one, thus far, this combination has proved superior to either the acetate or free form alone.

A much smaller series of patients (19) were treated systemically with injections of the acetate, the combined forms, and oral administration of the free alcohol form in tablets. Those were patients with involvement of more than one eye, or part of the body, or those who had not received sufficient benefit from topical and subconjunctival therapy.

The size of this series was also limited by the availability of the therapuetic material. It is obvious that a patient using 25 to 125 mg. daily is more of a drain on a small supply than one using one-third to one-half cc. of a 2.5-percent solution, every week or two.

Hydrocortisone, when employed systemically, was found to be effective in doses approximately one half to two thirds of that of cortisone when employed in the treatment of similar conditions. No patient received more than 100 mg. of the hydrocortisone

TABLE 6

HYDROCORTISONE (SYSTEMIC)

Diagnosis	No. Cases	Successful	Failures
Allergies	4	4	—
Orbital pseudotumor	1	1	—
Acute circinate retinopathy (stage of edema and deep hemorrhage)	1	1	—
Active chronic choroiditis	3	3	—
Acute choroiditis	1	1	—
*Herpes zoster keratitis	1	1	—
Optic atrophy	2	—	2
Optic neuritis	2	—	2
Generalized chronic uveitis	3	3	—

* This patient developed a severe generalized uveitis noted after the severe keratitis cleared. The uveitis failed to respond to the oral and subconjunctival hydrocortisone. Following several days of H.P. acthargel with good response, the uveitis then became amenable to further treatment with oral and later subconjunctival hydrocortisone.

daily as an initial dose and most dosages were rapidly reduced to 25 to 50 mg. of cortisone a day, with the patients well controlled on this. Systemic therapy was found very effective in the control of generalized allergic and inflammatory conditions, such as generalized allergies, a case of orbital pseudotumor, acute uveitis, chronic choroiditis, vernal conjunctivitis, and a severe case of herpes zoster keratitis.

An interesting case which later proved to be one of circinate retinopathy was seen during its initial stages with a marked edema of the macula, which was very dark in appearance, and with some transudates radiating out in the form of a macular star. This patient had a marked visual improvement from 20/200 to 20/40 on oral tablets of hydrocortisone. She did not respond well when subconjunctival injections of hydrocortisone were employed initially. The oral therapy rapidly cleared the macular edema although the macular star of hard transudates still remained.

A patient with optic neuritis who had responded well to ACTH in the high potency, long-acting form was discharged on oral hydrocortisone. The oral hydrocortisone did not control this patient as well as did the high potency corticotropin. In this connection one would gather from the literature that cortisone is not as effective in the treatment of optic neuritis as is corticotropin.

A patient with a severe generalized uveitis who had failed to respond to seven months of therapy elsewhere, including systemic cortisone, was first seen by me over a year ago at which time he responded very well to intravenous corticotropin. Whenever he was given a subconjunctival injection of cortisone in an attempt to utilize this as maintenance therapy, his condition would become worse immediately. He has been maintained well, during all of this period, on corticotropin in the long-acting and eventually in the high-potency form.

When this patient was given subconjunctival injections of hydrocortisone acetate, it was difficult to evaluate the effect. The response was questionable. His response to the free-alcohol form of hydrocortisone was dramatic with remarked additional clearing of the vitreous. However, the beneficial effects lasted from but three to five days.

When first seen by me, this patient's vision was a poor 20/200. On corticotropin vision has been maintained around 20/30 to 20/40, with the vitreous fairly clear.

His response to the combination of the hydrocortisone-acetate and free-alcohol forms has been most pleasing, with the results of a single injection lasting for at least three weeks. Obviously, subconjunctival therapy in this case made maintenance therapy much simpler than when a systemic preparation was used. I have the impression that this patient's chronic inflammatory condition is burning out slowly under this therapy.

Discussion

Topical applications of hydrocortisone have proved superior to cortisone in the treatment of similar conditions. These preparations have proved effective in the control of allergic and inflammatory reactions, as well as in the production of a form of local analgesia.

Hydrocortisone employed subconjunctivally or systemically has proved effective in some cases in which cortisone was comparatively ineffective, and in one case in which cortisone was apparently harmful. It has not proved effective in a very small series of cases of optic neuritis which do not constitute a very good trial group.

Hydrocortisone acetate was inferior to the free-alcohol form of hydrocortisone in the treatment of ocular disease by subconjunctival injection. A combination of the hydrocortisone acetate and free-alcohol form of hydrocortisone has proven very satisfactory both in subconjunctival and in intramuscular therapy.

As with cortisone and corticotropin, patients with acute self-limited diseases tend to respond without relapse, whereas, those with chronic disease tend to relapse after discon-

tinuance of hydrocortisone therapy.

The ideal treatment schedule in any severe intraocular inflammation, especially of the posterior segment, consists of an initial course of systemic therapy (oral or intramuscular) followed by subconjunctival and then topical therapy, as the disease responds. This statement also applies to the use of corticotropin and cortisone. Occasionally, intramuscular injections are effective when the oral medication has failed to produce the desired result.

Addendum

A large experience gathered since this paper was written substantiates the above conclusions. The oral use of hydrocortisone has been explored in more detail and has proved efficacious in the therapy of intraocular inflammations. Approximately 60 mg. daily has proved to be a good maintenance dose in chronic cases. There has been a surprising freedom from side effects such as Cushing's syndrome. For example, in a one-eyed man with severe Boeck's sarcoid uveitis of some years' duration, who had proved to be a problem in therapy, vision slipped to 20/200. An initial course of 100 mg. of hydrocortisone daily by intravenous drip restored his vision to 20/30. It has now been maintained at that level for five months on 60 mg. of hydrocortisone daily by mouth.

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PYOCYANEUS ULCER*

Clinical report and experimental investigation

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Pseudomonas aeruginosa causes a severe corneal ulcer which is easily recognizable clinically. The typical history is that of a minor abrasion of the cornea followed in one to three days by a rapidly spreading, dead-white ulcer with a characteristic ringed area of necrosis and a semitransparent center. Hypopyon may or may not be present. Early clinical recognition with immediate and adequate therapy is essential if the eye is to remain useful.

The drug of choice in treating this condition is yet to be determined. Bignell[1] obtained encouraging results with daily subconjunctival injections of streptomycin. In his series of 10 cases, although all eyes were saved, the best vision obtained was 6/18. Pencillin and the sulfonamides had been used by earlier investigators with equivocal results.[2, 3, 4]

Experimentally, more encouraging results have been obtained with the polymyxins. Ainslie and Smith[5] used polymyxin E in doses of from 100,000 to 500,000 units subconjunctivally in rabbits with considerable success. Wiggins[6] reported equally good results with the topical instillations of polymyxin B. Eareckon and others[7] saved an eye, but without useful vision, by belated therapy with polymyxin B and streptokinase-streptodornase.

Although in vitro[6, 8] and in vivo[5, 6] studies clearly demonstrate that the polymyxins are, to date, superior to other available antibiotics, the case here presented was treated with massive doses of streptomycin subconjunctivally topically and intramuscularly, since the antibiotic was available and polymyxin E was obtained only after the effectiveness of the streptomycin was already established. Polymyxin B, although available was not

* From the Medical College of Virginia.

considered because of its reputation as a severe local irritant.[9, 10]

The experimental investigation which follows was undertaken to clarify the confusion existing between the toxic and irritative effects of polymyxin B and E, and to determine the minimal effective dose of each in the treatment of infected corneas of rabbits.

Report of case

W.B.S., a man, aged 42 years, was struck in the right eye by a piece of metal at two p.m. on October 16, 1952, while punching steel. He was seen for the first time on the morning of October 17, 1952, at which time a small particle of steel and a rust ring were removed following instillation of sterile pontocaine solution, sterility established by culture. Hourly applications of one-percent aureomycin ointment were prescribed.

On October 18th, the abrasion had not healed and by October 19th the patient complained of an excruciatingly painful eye in which a dead-white ulcerated area measuring 2.0 by 3.0 mm. was seen on the cornea in the 2-o'clock meridian two mm. inside the limbus. There was a one-mm. hypopyon and a generalized haziness of the entire cornea.

A diagnosis of pyocyaneus ulcer was made from the history and the clinical appearance. Laboratory confirmation came four days later.

Intensive treatment was given as follows: Daily subconjunctival injections of 0.5 gm. of streptomycin in one ml. of two-percent procaine with 1 : 20,000 epinephrine solution, hourly instillations of streptomycin solution (0.1-percent), 1.0 gm. daily of aureomycin by mouth, 1.0 gm. twice daily of dihydrostreptomycin intramuscularly.

On October 20th, the hypopyon had disappeared and the ulcer, while still dead white in appearance, had not increased in size. Although the dead-white appearance of the ulcer was no longer apparent by the 10th day, therapy was continued on a reduced scale for an additional 10 days because of the likelihood of recurrence.

When vascularization became apparent during the second week of the disease, instillations of cortisone (2.5-percent solution) were prescribed four times daily for one month. At the end of this time, no vessels were to be seen, even under high magnification, with the corneal microscope.

On February 10, 1953, refraction revealed: O.D., −0.5D. sph. ⌒ −0.75D. cyl. ax. 175° = 20/20−1; O.S., −0.25D. sph. ⌒ −0.5D. cyl. ax. 150° = 20/20. In 1947, refraction had shown: O.D., −0.87D. sph. ⌒ −0.5D. cyl. ax. 183° = 20/20−1; O.S., −1.0D. sph. ⌒ −0.5D. cyl. ax. 152° = 20/20.

In vitro sensitivity tests

The organism isolated from the right eye of W. B. S. was found to be Bacillus pyocyaneous (Pseudomonas aeruginosa). Biochemic and morphologic characteristics were found to be typical.

All of the experimental investigation was carried out employing 18- to 24-hour subculture from the organism isolated from W. B. S.

In vitro sensitivity tests of the organism were made using three methods: (1) The tube dilution, (2) plate dilution, and (3) pad tests.

The *tube-dilution method* was that employed by Kagan and others[8] and described by them as the Hobby modification of the Brownlee and Bushy[9] technique. For this test, polymyxin B sulfate (Aerosporin), polymyxin E (Batch No. EA 124),* and dihydrostreptomycin† were dissolved in sterile distilled water and diluted in nutrient broth. To each 1.8 ml. of doubling dilutions in broth was added 0.2 ml. of a 24-hour uniformly dispersed broth culture of the test organism. After mixing all tubes were incubated 18 hours at 37°C. The endpoint was considered to be the least amount of the

* Obtained through the courtesy of Dr. D. S. Searle, Burroughs Wellcome Company, Tuckahoe, New York.

† Supplied by Charles Pfizer & Company, New York.

TABLE 1

RESULTS OF IN VITRO SENSITIVITY TESTS
Least inhibiting concentration (μg./ml.)

	Tube Dilution	Plate Dilution	Pad Test
Polymyxin B	5.0 μg./ml.	100 μg./ml.	25 μg./ml.
Polymyxin E	100 μg./ml.	100 μg./ml.	250 μg./ml.
Dihydrostreptomycin	1,000 μg./ml.	250 μg./ml.	250 μg./ml.

antibiotic necessary to inhibit growth as observed by absence of gross turbidity when compared to control tubes.

In the *plate dilution method,* doubling dilutions of antibiotic were added to 10.0 ml. quantities of melted nutrient agar cooled to 45°C. to yield final concentrations per milliliter of agar equivalent to those tested by the tube dilution. After hardening, the plates were inoculated by streaking the surface with the same culture employed as inocula for the first tests. Inhibition of growth was considered as the endpoint.

The *pad-sensitivity test* used was the same as that routinely employed in diagnostic laboratories. It consists in overlaying uniformly inoculated nutrient agar plates with 6.35 mm. filter-paper discs saturated with varying dilutions of the antibiotic tested. Clear zones indicating no growth are obtained around those pads containing an inhibiting concentration of the antibiotic.

Results obtained by these three methods of sensitivity estimation can be correlated, but by reason of a variety of biologic, chemical, and physical factors cannot be directly compared.

The observations, shown in Table 1, would indicate that the strain of Pseudomonas aeruginosa employed in this study can be considered relatively resistant to these antibiotics.

EXPERIMENTAL STUDY

TREATMENT OF PYOCYANEUS ULCERS OF CORNEAS OF RABBITS

Method of inoculation. Both corneas of 19 rabbits were marked in the center with a three-mm. trephine and the epithelium within the zone was denuded with a blunt spud. Organisms obtained initially from the reported case and grown for 24 hours on nutrient agar slants were rubbed into the abraded area with a cotton applicator.

The eye with the largest and more rapidly progressive ulcer was treated, the injections being consistently made just outside the limbus in the 12-o'clock meridian. The eye with the less-advanced ulcer remained untreated as a control. This procedure was followed because of the difference in susceptibility of each eye to the infection. Culture of each ulcer before treatment in every instance produced pure growths of Pseudomonas aeruginosa.

Preliminary investigations. Four rabbits demonstrated one eye each having almost complete superficial necrosis of the cornea after 48 hours. Two eyes received 100,000 units (10 mg.) of polymyxin E in procaine (two-percent solution) with epinephrine (1:20,000) subconjunctivally for two days. This was cut to 50,000 units (5.0 mg.) on the third day and continued for seven days. Two eyes received 0.25 gm. of dihydrostreptomycin in similar solution subconjunctivally for nine days. A fifth eye which demonstrated a 3.0 by 3.0-mm. ulcer after 48 hours was treated with 100,000 units of penicillin in the same solution.

Results. The conjunctivas of the eyes which received 100,000 units of polymyxin E became beefy red and the discharge became sanguinous after two days. For that reason, the dose was cut to 50,000 units. The discharge soon lost its sanguinous appearance and the beefy red coloring left the conjunctivas. The ulcers treated with polymyxin E healed with a three-mm. central scarring. The ulcers treated with dihydrostreptomycin

TABLE 2

RESULTS OF TREATMENT OF EXPERIMENTAL PYOCYANEUS INFECTIONS*

Rabbit	Ulcer Dead White after 18 Hours (size in mm.)	Treatment		Result	
				Treated Eye	Control
		Units	Polymyxin		
1	3 5	1,000	E	X	X
2	No take 3. mm. haze	1,000	E	X	
3	No take 5	5,000	E	X	
4	5 6	5,000	E	XXXX	Perforated
5	6 6	25,000	E	X	Perforated
6	3 6	25,000	E	X	Perforated
7	3 6	25,000	E	X	X
8	No take 2	1,000	B	X	
9	3 6	1,000	B	XX (discharge)	X
10	3 4	5,000	B	X	XXXX
11	2 2	5,000	B	X	XX
12	6 6	25,000	B	XX	XXXX
13	3 4	25,000	B	X	XX
14	6 6	25,000	B	X	Perforated

* Graded according to the method employed by Robert L. Wiggins, M.D.[4]
X = Central infiltration; healed with faint scarring.
XX = Dense central infiltration; healed with dense central scar.
XXX = More than one-half cornea infiltrated; healed with dense scar.
XXXX = Whole cornea infiltrated; healed with complete vascularized scar; perforated cornea ruptured.

healed with nearly complete vascularized scars of the corneas. The ulcer treated with penicillin was completely uncontrolled. The site of injection developed pus pockets and the eye healed with a completely vascularized dense scar.

Neither rabbit treated with polymycin E developed weakness or paralysis of the extremities.

POLYMYXIN B AND POLYMYXIN E.

Fourteen rabbits were under investigation. After 18 hours' incubation, treatment, consisting of daily subconjunctival injections of varying concentrations of polymyxin B and polymyxin E each in 1.0 ml. of procaine (two percent) with 1:20,000 epinephrine, was given for eight days.

Results. (See Table 2 and figs. 1 and 2). Three control eyes which showed four- to six-mm. dead-white ulcers after 18 hours perforated; two control eyes became completely scarred, with vascularization. One with a three-mm. ulcer perforated.

All ulcers, which at 18 hours showed a four- to six-mm. circumference and were treated with 25,000 units (2.5 mg) of polymyxin B or E, healed with only slight nebula or small central scar formation. Three of four ulcers treated with 5,000 units (0.5 mg.) of polymyxin B or E demonstrated faint nebulas. The fourth (polymyxin E) was uncontrolled and resulted in a completely vascularized scar. Dosage of 1,000 units (0.1 mg.) controlled the infection except in one instance. That one (polymyxin B) developed fresh discharge the day after therapy was discontinued and went on to complete scarring with vascularization.

The reaction of the conjunctiva to the introduction of the solutions of polymyxin B and E was mild. There was no detectable difference between the reaction to polymyxin B as compared with polymyxin E.

Of the 14 rabbits treated, one rabbit was found to have a paralysis of the hind legs 24 hours after the initial dose of 1,000 units of polymyxin B. This was not apparent prior to treatment but may have been overlooked. Two weeks after therapy had been discontinued, paralysis remained the same. Autopsy carried out at this time revealed no cause for the paralysis, although evidence of infection or injury was sought for.

Table 2 summarizes the results obtained.

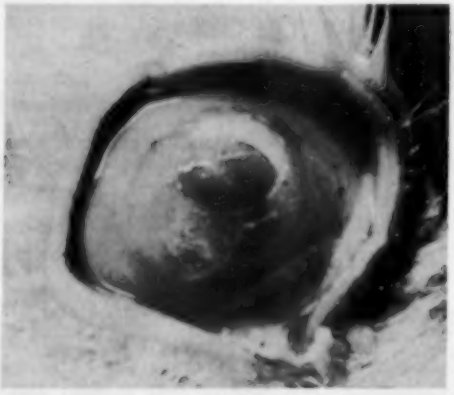

Fig. 1 (Williams, Hench, and Guerry). Photograph of control eye (rabbit 14 in Table 2) 16 days after inoculation.

Fig. 2 (Williams, Hench, and Guerry). Photograph of eye treated with 25,000 units of polymyxin B for eight days on 16th day after inoculation.

Figures 1 and 2 illustrate the results obtained in a typical control and treated eye (rabbit No. 14, Table 2).

Discussion

If any treatment of pyocyaneus ulcer is to be effective, prompt clinical recognition of the lesion is essential. Cultures should be confirmatory and not diagnostic for early therapy must be instituted if useful vision is to be obtained. The fact that, in many instances, the true nature of the lesion is not suspected until cultures are reported probably accounts for the cases of visual loss reported in the literature.

Streptomycin and the polymyxins are efficacious in controlling an early infection. However, once the organism is firmly established, therapy is globe saving but not sight saving. This is well illustrated in the in vivo lesions herein reported. In the preliminary experiments, in which 48 hours elapsed before therapy was instituted, even large antibiotic concentrations showed but slight effect in controlling the infection, while therapy with relatively low concentrations after an

18-hour incubation period was very effective. Polymxin E in dosages as high as 500,000 units has been injected into the conjunctiva of rabbits eyes without permanent damage.[8] In the rabbits reported here 100,000 units of polymyxin E caused severe irritation at the site of injection but, when the dosage was cut to 50,000 units, the extreme reaction subsided. Injections of, 25,000 units of polymyxin B and polymyxin E caused only slight irritation, and the degree of irritation of each was the same. In fact, 25,000 units of polymyxin B and E caused considerably less irritation to rabbit conjunctivas than 0.5 gm. of streptomycin did to the conjunctiva of the patient herein reported. This difference is more marked when one considers that the rabbits' injections were consistently given in the 12 o'clock meridian, while the injections in the case of W. B. S. were in different meridians each day.

Ainslie and Smith controlled pyocyaneous ulcers in rabbits by subconjunctival injections daily of from 100,000 units to 330,000 units of polymyxin E. It would seem, however, that they used tremendously large doses in relation to the sensitivity of pyocyaneus.[11] The experiments here tend to confirm this. Dosages as small as 1,000 to 5,000 units of polymyxin B or E controlled most of the infections and those of 25,000 units controlled 100 percent.

In vitro investigation by the tube-dilution method showed the least inhibiting concentration of polymyxin B, polymyxin E, and dihydrostreptomycin to be in the ratio of, respectively, 1:20:200. By the plate-dilution method, a ratio of 1 : 1 : 2.5 and, by the pad test, a ratio of 1:10:10 were shown. Polymyxin B, therefore, appears to be more effective in vitro.

In the in vitro investigation, the organism under observation appears to be somewhat more virulent than that employed by other workers.

Paralysis, which occurred in a rabbit receiving 1,000 units of polymyxin B, cannot be accounted for, since search for trauma and infection was not helpful. It seems incredible that a total of 1,000 units (0.1 mg.) could have caused it since others[8] have given as high as 1,980,000 units (198 mg.) in six days without any evidence of weakness.

On the basis of the findings already mentioned, polymyxin B appears to be the antibiotic of choice in pyocyaneus ulcers in human corneas. If given early, 50,000 units of the antibiotic by subconjunctival injection daily should control the ulcer. Local or systemic toxicity should not be expected with this small dose. Hourly instillations (10,000 units/cc.) should be a helpful adjunct.

Summary

1. A case of proved pyocyaneus ulcer of the cornea treated by large doses of streptomycin subconjunctivally, intramuscularly, and topically, and aureomycin orally is reported. Vision of 20/20-1 was retained.

2. In vitro investigation of the organism obtained from the case reported proved it to be highly virulent. Polymyxin B was more effective in controlling its growth than polymyxin E or dihydrostreptomycin.

3. Ulcers of the corneas of rabbits infected with this organism and treated after an 18-hour incubation period responded equally well to polymyxin B and polymyxin E in daily dosages of 25,000 units given subconjunctivally, when treatment was started early. The irritation caused by the antibiotics was mild. No difference in the local reaction between polymyxin E and polymyxin B was demonstrated.

4. The suggestion was made that 50,000 units of polymyxin B by conjunctival injections daily and instillation hourly of polymyxin solution be used in treatment of pyocyaneus ulcer of human corneas.

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FURTHER STUDIES ON THE EFFECT OF AGENTS ON REGENERATION OF CORNEAL EPITHELIUM*

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In a previous publication,[1] using a technique devised by Buschke and Friedenwald, it was shown that the available antibiotic derivatives of actinomycetes (streptomycin, chloromycetin, aureomycin, and terramycin) in concentrations used clinically and with the pH of the solutions maintained at 7.2 did not delay the healing of epithelial defects in the rat's cornea. Normal healing also took place when the sodium or potassium salt of crystalline penicillin G was used in a concentration of 2,500 units per cc.

Two nonmetallic organic antiseptics, zephiran and phemerol chloride, and two anesthetic solutions, butyn sulfate and tetracaine hydrochloride, prevented healing.

This paper presents the results obtained with some antiseptics not tested previously and with some of the more recently available antibiotics. In addition, experiments were undertaken to discover if, within the limitations of the technique employed, there was any evidence of stimulation of epithelization by calsulfhydryl (Hydrosulphosol®).

METHOD

The experiments were performed in the same manner as was described in the paper[1] published in 1951. For a more thorough discussion of the technique the original publication of Buschke and Friedenwald[2] may be consulted. Briefly, with a fine needle, small circular epithelial defects were produced in the cornea of an anesthetized rat's eye, the eyes were enucleated and placed in test solutions. The pH of the test solution was maintained at neutrality with a buffer and the solution with the enucleated eyes aerated for

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three hours at a temperature of 38°C. Following the aeration the eyes were removed and the corneas prepared so that the epithelial defects could be examined under the high power of the microscope.

The nuclei of cells around healed defects showed an increased staining and the nuclei of cells, especially of the basal layers, were arranged in a radial pattern and the cells covered the floor of the defect (fig. 1). The nuclei of cells around an unhealed lesion did not show an increased staining and the nuclei were in a tangential pattern rather than in a radial arrangement to the uncovered defect (fig. 2). In lesions showing retarded healing the nuclei were arranged in a radial pattern at the periphery but the defect was still present and uncovered.

In earlier experiments it was found that the epithelial defects were practically all healed after three hours in Sorenson's phosphate buffer with a pH of 7.2. Little observable change could be seen in the epithelial defects after one hour but after the second hour the defects changed rapidly. Observations made after two, and two and one-half hours against controls were used to ascertain whether there was any evidence of stimulation of epithelization by the substance being tested.

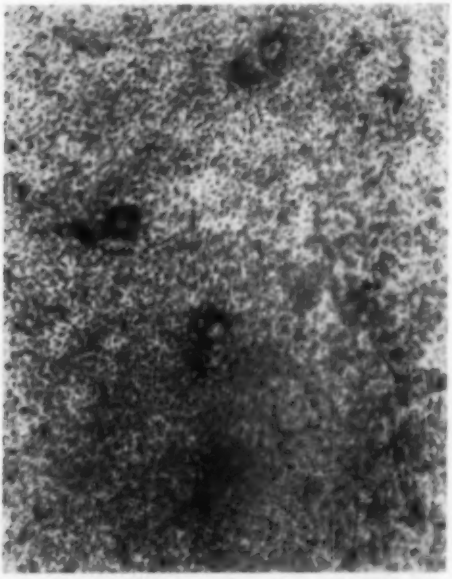

Fig. 1 (Marr, Wood, and Grieves). Photomicrograph, showing healed epithelial defects.

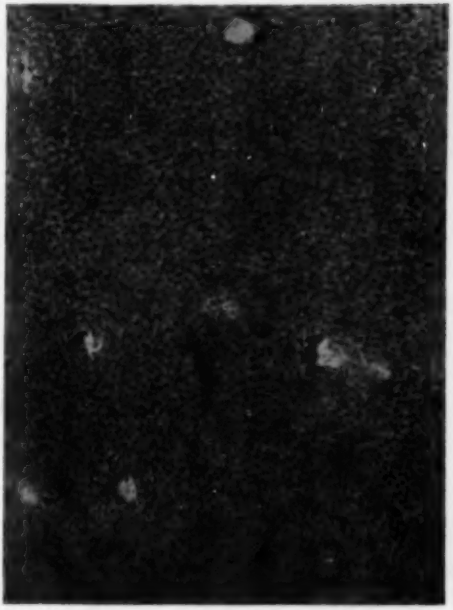

Fig. 2 (Marr, Wood, and Grieves). Photomicrograph, showing unhealed epithelial lesions.

Results

Table 1 shows the results obtained when the eyes were placed for three hours in Sorensen's phosphate buffer solution at a pH of 7.0 in the presence of the various agents under investigation. The controls were eyes placed for three hours in Sorensen's phosphate buffer solution at a pH of 7.0.

Polymyxin B sulfate, a polypeptide antibiotic derived from a bacillus, did not delay healing in a concentration used clinically of 20,000 µg. per ml.

Erythromycin,* a recent derivative from an actinomycete, is mainly active against

* We wish to thank the following companies for generously supplying the indicated material: Eli Lilly & Co., erythromycin; Charles Pfizer & Co., Inc., carbomycin; the Upjohn Co., circulin; Merck & Co., Inc., MK-65.

TABLE 1

RESULTS OBTAINED WITH VARIOUS AGENTS

Agent in Buffer	Concentration	Normal Healing	Retarded Healing	No Healing
Control (Sorensen's phosphate buffer)		+		
Polymyxin B sulfate	20,000 μg./ml.	+		
Polymyxin B sulfate	5,000 μg./ml.	+		
Erythromycin	2 μg./ml. (alc. 1:100)	+		
Viomycin sulfate	2.5 mg./ml.	+		
Viomycin sulfate	0.1 mg./ml.	+		
Carbomycin (magnamycin hydrochloride)	500 μg./ml.	+		
Carbomycin (magnamycin hydrochloride)	100 μg./ml.	+		
Neomycin sulfate	3.5 mg./ml.	+		
Neomycin sulfate	1.0 mg./ml.	+		
Circulin	3.5 mg./ml.			+
Circulin	1.0 mg./ml.	+		
MK-65	50 mg./ml.		+	
MK-65	5 mg./ml.	+		
Nitrofurazone (Furacin)	0.2 mg./ml.		+	
Nitrofurazone (Furacin)	0.02 mg./ml.	+		
Sodium propionate (Propion)	5%			+
Sodium propionate (Propion)	0.5%	+		
Sulfamylon	5%			+
Sulfamylon	0.5%			+
Phenazoline (Antistine)	0.5%			+
Phenazoline (Antistine)	0.05%		+	

gram-positive organisms. Erythromycin is relatively insoluble and was used in a concentration of 2.0 μg. per ml. This concentration was obtained by disolving the powder first in a small amount of alcohol and then in the buffer. In the resultant solution alcohol was present in a dilution of 1:100. Erythromycin is stable at a pH of 7.0 but, at a pH below 6.0, it decomposes in a matter of hours. The erythromycin solution did not delay healing nor did a control solution of the buffer containing alcohol 1:100.

Viomycin sulfate,[3] a new tuberculostatic antibiotic derived from an actinomycete, was tested. It has antibacterial activity in the pH range from neutrality to 8.5. Viomycin did not inhibit healing in a concentration of 2.5 mg. per ml.

Carbomycin* (magnamycin hydrochloride), another derivative from an actinomycete, is principally active against gram-positive bacteria.[4] Carbomycin is fairly soluble and in the concentration of 500 μg. per ml. did not interfere with healing.

Neomycin sulfate, also from an actinomycete, is readily soluble in water. Neomycin did not delay healing in a therapeutic concentration of 3.5 mg. per ml.

Circulin,* an antibiotic obtained from a bacillus, is mainly active against gram-negative organisms.[5] Circulin prevented healing in a concentration of 3.5 mg. per ml. However, in a concentration of 1.0 mg. per ml., normal healing took place.

MK-65,* a new broad-range antibiotic obtained from a soil organism, is freely soluble and delayed healing in the high concentration of 50 mg. per ml. but healing occurred at the normal rate with a concentration of 5.0 mg. per ml. This latter concentration probably will be closer than the former to the strength used clinically.

Nitrofurazone (Furacin) is not very soluble in water and in the concentration used therapeutically, which is 0.2 mg. per ml., retarded healing while in a concentration of 0.02 mg. per ml. normal healing took place.

Sodium propionate (Propion) prevented healing in a five-percent concentration which is the strength used clinically. Normal healing occurred with a 0.5-percent solution.

Sulfamylon, a sulfonamide compound,

We wish to acknowledge the technical assistance of Miss Sylvia Sigelman.

TABLE 2

RESULTS OBTAINED WITH CALSULFHYDRYL

Agent in Buffer	Time (hr.)	Concentration	Normal Healing	Retarded Healing	No Healing
Control (Sorensen's phosphate buffer)	3		+		
Calsulfhydryl (Hydrosulphosol)	3	Undiluted			+
Calsulfhydryl (Hydrosulphosol)	3	1:40		+	
Control (Sorensen's phosphate buffer)	2½		+		
Calsulfhydryl (Hydrosulphosol)	2½	1:40		+	
Control (Sorensen's phosphate buffer)	2		+		
Calsulfhydryl (Hydrosulphosol)	2	1:40		+	

prevented healing in both the clinically used five-percent concentration and in a 0.5-percent concentration.

Sulfisoxazole (Gantrisin) is another sulfonamide compound but the powder was not soluble in the phosphate buffer. Gantrisin ophthalmic solution (four percent) was diluted with the phosphate buffer 1:5 and with this dilution normal healing took place.

In Table 2 may be seen the findings resulting from the use of calsulfhydryl (Hydrosulphosol). Hydrosulphosol was not available in the powder form but was obtained as a solution. This solution was used undiluted and also was diluted 1:40 with the usual phosphate buffer. The solution was diluted 1:40 because this is the strength suggested in one of the clinical reports.[6] The eyes remaining in the undiluted Hydrosulphosol solution for three hours showed no evidence of healing while the epithelial defects in the eyes in the 1:40 dilution for the same length of time showed retarded healing as compared to the controls.

In an effort to determine if there was any evidence for stimulation of epithelization three eyes were placed in 1:40 Hydrosulphosol solution for two and one-half hours and three other eyes were placed in 1:40 Hydrosulphosol solution for two hours. Control eyes were placed in Sorensen's phosphate buffer for identical periods of time. In both cases the eyes which were in the diluted Hydrosulphosol solution showed less healing of the epithelial defects than did the control eyes.

COMMENT

This method of study eliminates the possibility of infection influencing the rate of healing of the corneal abrasion as may occur when the cornea of a live animal is abraded and the healing observed for several days.

This approach cannot be used for some drugs which, because they are also dyes, obscure the staining and cellular detail of the corneal specimen. In addition this technique is not suitable for some surface-tension reducing agents because the epithelial layer is frequently separated from the corneal stroma in the fixed and stained specimen. This separation of the epithelial layer occurred in a preliminary test with sodium-potassium copper chlorophyllin which is prepared by saponification.

CONCLUSIONS

Using a technique devised by Buschke and Friedenwald with the pH of the test solution maintained at neutrality by Sorensen's phosphate buffer it was found that polymyxin B sulfate, erythromycin, viomycin sulfate, carbomycin, and neomycin sulfate in the concentrations described did not delay the healing of epithelial defects in the rat's cornea.

The effect of several other compounds was also determined. Calsulfhydryl in the concentrations employed showed no evidence of stimulation of epithelization.

The Johns Hopkins Hospital (5).

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PRESENT CONCEPT OF SUPERIOR OBLIQUE SURGERY*

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Previous to 1942, the literature is practically devoid of references to the surgical correction of superior oblique defects. Operative measures were not considered feasible, and the general attitude was well expressed by Jackson,[1] in 1903, when he stated that, because of its deep insertion, operative steps upon the tendon of the superior oblique near its insertion are not practical.

This feeling was confirmed by Banister,[2] in 1928, when he said that, owing to the anatomic relations of the superior oblique muscle to the eyeball, its deep location in the orbit, and it attachments to the globe in the neighborhood of the equator, surgical procedures are out of the question. In attempting to relieve the distressing diplopia in such instances of paralysis, he believed that the ophthalmic surgeon must make use of the recti muscles.

In 1934, Wheeler[3] introduced an operation for underaction of the superior oblique. Apparently the procedure was not widely accepted, judging from the absence of reports in the literature. The majority of attempts to correct a superior oblique defect continued to deal with yoke or direct antagonist muscles and, as far as can be detremined, only in rare instances was the tendon of the superior oblique operated upon. The belief of most ophthalmologists that it is dangerous to operate upon the superior oblique was deeply ingrained.

As accurately as can be determined, no further operations on the superior oblique were reported until 1940, when Meesman[4] described overaction of the superior oblique and its successful treatment by resection of the trochlea. In 1942, Malbran[5] made a similar report. In the same year, Hughes and Bogart[6] described a method of recession of the trochlea in cases of overaction of the superior oblique.

In 1946, Berke[7] reported a series of cases in which a tenotomy of the superior oblique tendon was performed to relieve hypertropia in patients with overaction of this muscle. In 1946, McGuire[8] reported a series of cases of underaction of the superior oblique for which he resected the tendon.

The present trend in surgery of the superior oblique muscle was expressed by White[9] when he wrote, "I have found no occasion to keep 'hands off the obliques' when by tests such surgery is indicated." And the increase in the number of papers on this subject in recent years reveals, more than anything else, the change in attitude.

There seems to be developing a tendency

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* Presented before the New England Ophthalmological Society, October, 1951.

on the part of the surgeon, in dealing with a superior oblique problem, to confine the operative procedure to the field involved, and not to disturb a normal field by operating upon a normal rectus when a superior oblique is the primary offender. According to these views, the surgeon should not hesitate to perform a surgical step on a superior oblique muscle if it is the primary causative factor in a defect, or if it is preventing efficient binocular action as a secondary factor.

This revised viewpoint is due chiefly to a better knowledge of the anatomy of the superior oblique, revealing its accessibility and permitting the application of many surgical principles found most effective in surgery on the recti.

The factors which have been fundamental to the development of our present-day concept of superior oblique surgery are:

1. An appreciation of the importance of superior oblique defects.
2. Accurate methods of diagnosing superior oblique defects.
3. A knowledge of the principles involved in the management of these cases.
4. An adequate knowledge of the anatomy.
5. The selection of effective surgical procedures.
6. A background of experience in this field.

1. Importance of superior oblique defects

As our knowledge of oculomotor defects has increased, we are more and more impressed with the important role of superior oblique defects in strabismus. It is increasingly evident that a superior oblique defect in heterotropia is an important motor obstacle to binocular co-ordination; when associated with a horizontal deviation, it is frequently the true underlying imbalance, the horizontal deviation actually being a secondary phenomenon.

Lack of proper consideration of the superior oblique deviations has frequently resulted in disappointing therapeutic results. Horizontal surgery, in the presence of an unrecognized superior oblique defect, results in cosmetic improvement alone, almost never in the functional improvement which is the goal of surgery. Not only this, but even a good cosmetic result in lateral deviations is frequently lost because of an unrecognized superior oblique factor.

Most of us have seen patients who, presumably, have only a horizontal deviation and who have had several operations—all unsuccessful—on the horizontal muscles only. Many of these cases have a superior oblique defect and, when the vertical surgery was done and then one final lateral procedure, the results were good. It seems certain that these unfortunate patients could have been saved repeated operations if the vertical component had been recognized. (White,[9] in discussing the operative failure of many excellent surgeons, stated that, almost without exception, a vertical imbalance was present in these cases.)

Experience, therefore, seems to indicate that a superior oblique defect is a definite motor obstacle and a person with a horizontal strabismus should not be operated on or otherwise treated without a thorough study and analysis of the vertical component. Rules for correction of a horizontal deviation are not the same in the presence of a vertical defect, especially if it is caused by an abnormal action of a superior oblique.

2. More accurate diagnostic criteria

In the past, there has been much confusion in our methods of diagnosing superior oblique defects. As a result of this lack of agreement in our diagnostic criteria, there is a discrepancy among statistics as to the frequency of superior oblique involvement. Common agreement as to diagnostic procedures and interpretations in these cases would do much to promote a uniformity of opinion. Definite criteria should be set up for differentiating the various vertical defects.

Two well-established schools of thought exist regarding the occurrence of isolated

primary superior oblique underaction. One considers that involvement of the superior rectus is the common lesion and that superior oblique involvement is rare. The other school takes the view that the superior oblique is a more common offender. Though the relatively frequency of these lesions varies in different statistics, all agree that the combined figure is high.

The situation is further confused by the fact that statistics do not always indicate whether the vertical palsy is an isolated palsy or combined involvement of the vertical muscles. Scobee has emphasized the fact that various combinations of more than one vertical muscle are present more frequently than usually thought.

From available evidence it is not possible to make an exact statement as to the frequency of superior oblique involvement. However, weighing all the evidence, it seems such involvement should be found in a greater percentage of cases than usually reported. If diagnostic stress is laid upon the direction of head tilt and the results of Bielschowsky's head-tilting test, the superior oblique undoubtedly will be implicated as the primary offender in a larger percentage of cases. Judging from my own experience, defects of the superior oblique muscle are more common than generally recognized, especially anomalies of mild degree. Definite diagnostic criteria should be established, so that more accurate interpretation is possible.

Principles governing diagnosis

a. *The principal action of the superior oblique.* Although the principal action varies with the direction of gaze, rotation down and in indicates the field in which the vertical action is greatest. It is the field of primary importance in diagnosing abnormal oblique action.

b. *Postural attitude is important.* The superior oblique involvement produces a characteristic head position which is of great diagnostic value.

c. *The determination of the fixating eye.* Whether or not the patient is fixating with his normal or involved eye is of importance in analyzing a case in which a superior oblique defect is present.

d. *The stage of development* is an important consideration. The manifestations differ according to the duration of the involvement. If the underaction of the muscle is of recent origin, there is little difficulty in diagnosing the affected muscle.

In the later stages of acquired and congenital squint, a more complex picture with greater diagnostic problems is encountered and intensive investigation may be required to determine the nature of the original lesion.

Diagnostic procedures

In analyzing a case the examiner has at his disposal a number of diagnostic procedures. Conditions, such as the age of the patient, time of onset, causative factor, visual acuity, and the degree of binocular action, determine which tests should be employed and which should be omitted.

Generally speaking, rules for the selection of tests may be summarized as follows:

Objective tests only should be used for the very young child or the older child or adult in whom a definite amblyopia or a marked suppression exists. The subjective tests are of more value when the patient is mature enough to understand what is desired. If suppression is not deep, amblyopia is not pronounced, and correspondence is normal, both objective and subjective tests may be performed, but the subjective tests should be considered supplementary procedures. Both objective and subjective tests are used when the case is of recent onset or if single binocular vision exists.

Testing procedures

Diagnosis of the case is based, for the most part, on procedures which analyze three objective symptoms—abnormal deviation of the eyes, limitation or excess of movements, and the adoption of compensating postural attitudes—and two subjective symptoms—

those of diplopia and false orientation.

The tests found to be most valuable in the diagnosis of superior oblique defects are: Prisms and cover test, binocular rotations or versions, head tilt (ocular torticollis), head-tilt test, and the Lancaster test. The correct application of these tests will do much to obtain a correct analysis of a superior oblique defect.

3. Principles of management

A review of recent publications indicates that our present concept of superior oblique management conforms to certain principles. Briefly stated, they are:

a. Correction of the vertical deviation should be accomplished as early as possible in the life of the child. This is of paramount importance for the following reasons: (1) The torticollis is disfiguring and, in time, produces a spastic contracture of the muscles of neck, head, and trunk (2) A congenital or infantile palsy changes its characteristics and becomes more complicated owing to structural changes in the affected muscle, in its antagonist, and in the synergist in the other eye. (3) Suppression and amblyopia may occur if the case is not treated early. (4) The deviated eye becomes a serious detriment to the child's appearance; the psychologic, social, and economic importance of such a condition cannot be overestimated.

b. In every case the refractive error must be determined and, if necessary, corrected. Further therapeutic procedures should be decided upon only after the correction has been worn by the patient for a certain length of time.

c. If the vertical deviation is moderate in amount and is fairly comitant, prisms may give the patient comfort. Prisms are useful only if there is a fairly large field of comitancy.

d. Fusion exercises are usually of little value in increasing the patient's ability to overcome his symptoms. Fusion training, however, may make secondary contractions more pronounced; taking the eyes forcibly into the field of action of a weak muscle may stimulate the associated muscle of the opposite eye.

e. Surgical treatment.

Correction of the defect by surgery is indicated when the other measures are inadequate, when the defect is causing sufficient symptoms, or for cosmetic reasons. Operative treatment aims to secure a more physiologic position of rest so that less mechanical adjustment is necessary on the part of the neuromuscular mechanism and the fusion faculty.

Many operative cases fail to be relieved, not because operation was contraindicated or was improperly performed but because the wrong muscles were chosen for surgery. This error can usually be avoided by careful analysis of the case. Because binocular vision exists in some cases, operative failures may greatly incapacitate the patient.

Great care should be taken not to overcorrect a vertical defect. Because of the peculiar anatomic arrangement of the vertical muscles, vertical defects are usually moderate in amount as compared with horizontal defects. Also a few millimeters of correction on a vertical muscle is much more effective in producing the desired result than the same amount of surgery on a horizontal muscle. Overcorrection of a vertical defect may create an insurmountable mechanical obstacle to binocular vision because of the very limited vertical fusion amplitude.

Surgery is not limited to vertical defects of high degrees but can be used effectively in moderate defects. In fact, small amounts of vertical deviation lend themselves well to surgery.

The following are fundamental in the surgical management of these cases:

1. In acute paralyses, the underlying cause should first be treated whenever possible. When the final outcome has been established, surgical correction should be considered.

In paresis of traumatic origin it is wise to consider the possibility of recovery without operation.

2. Diplopia is often a reason for operation. Usually, however, operation is for the secondary symptoms it causes—head tilting, confusion, vertigo, and nausea. Although it is not always possible to abolish diplopia by operation, the deviation can be made more comitant.

3. Determination of the fixating eye is generally considered an important factor in selecting the muscle on which to operate.

There is, however, a question in the minds of some at the present time as to whether the fixating eye should be a determining factor in all cases. They believe that the rule should not be rigidly followed, but considered as a generalization—that situations are too variable to permit of an inflexible guide. For example, suppose the right superior oblique is underacting, and the patient fixates with this eye. Is it not more logical as a first step to attempt to strengthen the primary offender than to recess the associated left inferior rectus which is overacting and by this operation produce a weakness of both depressors? The recession of the associated inferior rectus can be done as a second step if necessary.

4. It should be understood from the outset that ultimate correction cannot be expected from one operation in the great majority of cases. It is a mistake in most instances to plan the required surgery for one sitting. In general, in dealing with oblique problems, the surgeon should be content with an undercorrection that may be amenable to further procedures rather than to accomplish too much and find reconstruction difficult.

5. It is usually necessary to operate on both eyes when there is a marked degree of strabismus; an extensive operation on one eye may produce an unsatisfactory result.

6. The question of surgery on the superior and inferior rectus muscles should receive serious consideration. Some experienced surgeons are hesitant in advising surgery on the vertical recti, as they have found that such operations occasionally disturb the lid position or lessen ocular efficiency in the field of the muscle action. This disturbance may be serious, especially in the lower field used so much in close work, walking, and so forth.

Anatomic and clinical evidence indicate that surgical measures applied to the vertical recti may lead to the following complications:

1. Abnormal lid position, either sagging or elevation, gives a poor cosmetic and functional result. It is difficult to realize that even a slight change in the insertion of a vertical rectus muscle may appreciably alter the position of the adjacent lid.

2. Because of their intimate relationship, surgical measures applied to the vertical recti may cause postoperative adhesions, which interfere with the action of the adjacent obliques.

3. Surgery on the vertical recti may cause a disturbance in the check ligaments, not only of the operated rectus but also the adjacent oblique, owing to the intimate fascial arrangement.

4. Surgery on the vertical recti may increase an already existing torsional defect. Weakening operations, although tending to neutralize the vertical defect in the primary position, may add to the already existing imbalance a new and unnecessary defect in the field of action of the operated rectus muscle.

5. Surgery on a vertical rectus may alter the rotation of one eye, thus reducing the field of binocular single vision in the upper or lower visual field. This is especially important in the case of the inferior rectus because of the importance of the lower field of vision.

Since evidence obtained from anatomic studies and clinical experience seems to indicate conservatism in operating on the vertical recti, I approach these muscles with due consideration and, when an oblique muscle is primarily involved, reserve operation on the vertical rectus muscle for a secondary step whenever possible.

In more pronounced cases of oblique muscle involvement, a more liberal operation is performed on the affected muscle in conjunction with surgery on the associated vertical rectus. It has been my experience

that, in these pronounced cases, a vertical rectus can be resected as much as five mm., but should not be receded more than three mm.

Surgical indications. In formulating the indications for operation on the vertical muscles, a number of factors must be considered, such as the degree of underaction or overaction, the fixating eye, the presence of amblyopia, whether the defect is unilateral or bilateral, the presence or absence of fusion, and so forth.

It is obviously impossible to describe operative indications for all situations. The following discussion, therefore, merely attempts in a general way to outline the steps which have proved most satisfactory in the management of these conditions. It assumes that only one muscle is primarily involved, a condition which does not always exist, and it takes for granted that the offending muscle has been identified.

In such a presentation one must be dogmatic, although in the actual management of the case it may not be possible to formulate a procedure until the time of operation, and even then the surgeon may be in doubt. The lack of uniformity of opinion among various surgeons as to the surgical indications for vertical defects is understandable if one remembers that individual experience is an important factor in the selection of operative steps.

Up to a few years ago it was an established procedure to weaken or strengthen a normal rectus muscle in an effort to overcome the effect of an abnormally acting superior oblique. Although such a step might improve the balance in eyes front, the defect remained when looking in the field of the affected oblique. The present trend seems to be that, if a superior oblique is underacting, it should be strengthened; if it is overacting, it should be weakened. In other words, if the oblique is the primary offender, it should be treated first rather than a normal associate muscle. This is especially true of the associate superior or inferior rectus muscles; anatomic studies and clinical experience both emphasize the hazards of surgical intervention on the vertical rectus muscles.

Underaction of the superior oblique

The choice of operation is not always easy. In general, the involved muscle should be strengthened. If the antagonist is structurally contracted, it should be recessed to give relief to the underacting muscle. If the contralateral synergic muscle overacts strongly, and particularly if this has resulted in structural contraction, it should be weakened; similarly, the contralateral antagonist may require strengthening. A given case may require one or more of these steps for correction.

My management of these cases may be briefly summarized:

In the minor degrees of underaction, with a gradual increase in hypertropia in the field of action of the affected superior oblique muscle (lower nasal field of the affected eye), the symptoms may be too slight to require treatment, or vertical prisms may suffice if the condition is fairly comitant.

In cases of moderate underaction of the superior oblique, a strengthening operation on this muscle may suffice.

In more pronounced cases, in addition to the strengthening operation on the superior oblique, it is necessary to recess the homolateral inferior oblique, especially if it is overacting. Such a step strengthens the lower visual field and does not weaken a normal rectus muscle. Weakening the contralateral inferior rectus should be reserved for a second operation; in most instances the secondary overaction of this muscle gradually lessens, so that frequently a second operation is unnecessary.

Overaction of the superior oblique

In dealing with overaction of the superior oblique, I have found the following procedures most satisfactory:

If overaction of the superior oblique is moderate in degree and associated with moderate underaction of the homolateral inferior

oblique, which appears to be the primary factor, a strengthening operation of the homolateral inferior oblique is the primary step and is frequently sufficient to produce the desired effect. Not only is it more logical on theoretic grounds but it is also more practical to avoid, when possible, weakening the superior oblique which is the most important vertical muscle in the position of depressed convergence, an essential position of gaze.

If underaction of the inferior oblique is pronounced, a strengthening operation on the inferior oblique would not prove sufficient. In this case, a tenotomy of the homolateral superior oblique is performed at the same time as the operation on the inferior oblique. If overaction of the superior oblique is moderate, a simple tenotomy is adequate. However, if overaction of the superior oblique is pronounced, tenotomy is not sufficient and a portion of the tendon may be removed to augment the effect.

When overaction of the superior oblique is associated with underaction of a contralateral inferior rectus, which is apparently the primary factor, it has been my experience that, in cases of moderate degree, too pronounced to be corrected by prisms but causing binocular inefficiency, moderate resection of the inferior rectus is indicated. A tenotomy of the contralateral superior oblique may be considered later if the result has been insufficient. Weakening of the superior oblique as a primary step seems inadvisable because it produces a weakness of two depressors. If underaction of the inferior rectus is more pronounced, it is usually necessary to resect the inferior rectus and tenotomize the overacting contralateral superior oblique in the same operation, the amount varying with the degree of underaction of the inferior rectus.

In my experience a seemingly primary overaction of the superior oblique has been invariably due to an involvement of an associate muscle which has practically recovered. In such a case, the overacting superior oblique should be weakened if the overaction is producing binocular inefficiency and the defect is too pronounced to be corrected by prisms.

In general, it seems most logical to approach the primary offender when it can be determined and avoid a weakening operation on a depressor, unless the amount of deviation makes this step necessary. It is better judgment to undercorrect and at a later period do a second operation. It has been occasionally observed that, after several months, a second operation is unnecessary, even in cases in which the defect seemed too great to be corrected by only the initial operation.

It is impossible to describe operative indications for all situations because of the great variability of the situations encountered. For example, if an eye is markedly amblyopic and does not respond to occlusion, the procedure is modified, the operative steps being confined to the amblyopic eye as much as possible. The discussion just presented, therefore, merely attempts in a brief and general way to outline the steps which have proved most satisfactory in my experience.

I wish to caution against ill-advised operation on the superior oblique. Like all therapeutic procedures, it should be carried out only for definite indications. From a physiologic point of view, we are dealing with a field of motor activity which the patient employs throughout his daily life with binocular co-ordination, that is, the down-and-in position of reading. As long as we are operating on children in whom suppression has been learned as a result of congenital palsies of the superior oblique, we cannot get into serious trouble. In operating for tropias or phorias in adults, however, there is danger of producing a disturbing diplopia. The diplopia produced by faulty activity of the superior oblique is torsional, the most annoying type a patient can experience.

4. Anatomy of the superior oblique

In selecting an operative technique, the surgeon is inevitably guided by the anatomic

arrangement of the area. This is especially true in the case of the superior oblique where a clear understanding of the anatomy will permit a safe approach and a utilization of the surgical principles known to be most effective in surgery of the rectus muscles. With a detailed anatomic knowledge of the area, the surgeon can visualize the structures both in their entirety and in their interrelationship with each other, thus being able to cope more effectively with the surgical problems encountered and to avoid the possible pitfalls. An ill-advised surgical procedure not only may be ineffectual in achieving normal physiologic action of the muscle in question, but may also cripple the action of other muscles as well.

In considering the anatomy of the superior oblique from the surgical aspect, certain factors seem evident:

a. Surgery on the superior oblique muscle should be confined to the reflected tendon and its insertion.

b. The logical approach for surgery in this area would seem to be under the upper lid in the region of the insertion of the superior rectus muscle. Approaching the muscle at this point should permit access to the oblique tendon with the least possible trauma to the surrounding tissues.

c. The anatomy of the area of the superior rectus is such that a tenotomy may disrupt the normal action of the superior oblique tendon because of its proximity.

The statement that a tenotomy of the superior rectus does not cause trouble is thus still open to question. Indeed, anatomic evidence indicates that any surgical procedure on the superior rectus, whether a tenotomy or an advancement or a recession of the insertion, may unfavorably influence the adjacent structures to a variable degree.

Certain points pertaining to the anatomy of the superior oblique tendon should be considered.

a. The reflected tendon of the superior oblique from the trochlea to the insertion is about 18 mm. (three-fourths inch) long. From the trochlea to the nasal edge of the superior rectus it measures 10 mm. There are, therefore, but eight mm. of tendon from the nasal edge of the superior rectus to the insertion.

b. The tendon is but two or three mm. in diameter until it approaches within a few millimeters of the superior rectus muscle, where it spreads out into a very thin, translucent membrane which is friable and shreds easily.

c. Surrounding the oblique tendon medial to the superior rectus and connecting it to its sheath are numerous tiny hairlike, fibroelastic fibers. Because of these fibrillas, independent movement of the tendon in this region becomes negligible and the movement which results when the eye is rotated involves both the tendon and its fascial sheath. Because the fibrillas limit the amount of retraction of the tendon, the degree of effect can be regulated when the tendon is incised.

d. The tendon of the superior oblique passes two to three mm. posterior to the nasal end of the insertion of the superior rectus when the eye is directed straight ahead.

e. The superior oblique has the most variable line of insertion of the oculorotary muscles.

f. Another factor to be stressed is that the superior oblique tendon is avascular fibrous tissue, and the operator must take into consideration that such tissue does not lends itself to surgery. It is difficult to conceive how resection of only the tendon would result in a firm structure when healed; logically a stronger union will result if the fascial covering is included with the severed tendon.

The fascial sheaths call for special consideration in surgery of the area.

5. Selection of effective surgical procedures

The following operative techniques have been selected because they seem most feasible from the anatomic standpoint; and most effective from the functional standpoint.

Overaction of superior oblique

On the basis of available data, the most effective procedure aimed at weakening an overactive superior oblique muscle is tenotomy of its reflected tendon. Although the method is comparatively new so that very few data are available to substantiate this statement, it is feasible procedure from an anatomic standpoint. The results obtained to date indicate its possibilities, although more experience in applying the method will give a more accurate evaluation. It seems unlikely that a complete paralysis will later result.

The amount of anticipated effect from the operation is not positively known. Experience indicates that a tenotomy will produce less effect than tenectomy, that a larger tenectomy will produce a greater effect than a smaller one, and that the effect will be greater the closer the tenotomy or the tenectomy is to the pulley.

In other words, the effect may be varied, depending on the amount of tendon removed and the place of its removal. If the tendon is cut close to the medial edge of the superior rectus, the effect will be less; if cut close to the pulley, complete paralysis will result.

As a general rule, the following suggestions will not lead one astray:

a. For a deviation of five to 10 prism diopters (with eyes front) a simple tenotomy is done.

b. For a deviation of 10 to 20 diopters, three to five mm. of the tendon are removed.

c. For a deviation of 20 to 30 diopters, five to eight mm. of the tendon are excised.

d. For complete paralysis of the superior oblique, a part of the tendon and its sheath should be excised near the pulley.

Underaction of superior oblique

The tuck operation has proved the most satisfactory procedure for this condition in my hands. The operation has been greatly simplified and the result is more predictable when the tucker devised by me for this operation is used. (fig. 1).

Fig. 1 (Fink). *Superior oblique tucker.*

The instrument is designed especially for tucking the superior oblique. As it is a reverse-action instrument, the instrument handle is compressed in applying it to the oblique tendon. When the tendon is in place on the arm of the instrument, the pressure on the instrument is released and the tendon is drawn through the opening of the tucker. The amount of tuck can be regulated by a set screw.

The instrument has the advantage of being smaller than the regulation tucker and of such design that this technically difficult step is made more simple than when the regulation tucker (which is designed for the horizontal muscles) is used.

Another important advantage of the instrument is that, because of its design, the tuck can be placed closer to the oblique insertion.

With this instrument the amount of tuck can be more accurately gauged and can be applied close to the tendon insertion. If the tuck is placed close to the oblique insertion, there is less possibility of the tuck encroaching on the trochlea, causing limitation of the rotation of the globe in this field.

The approach to the tuck operation is best made lateral to the superior rectus because of the greater ease in exposing the insertion of the superior oblique tendon.

Although resection of the superior oblique tendon is favored by some, experience seems to indicate that the resection has certain disadvantages as compared with the tuck operation: (a) The amount of effect can be more accurately gauged with the tuck; (b) the operative effect is as great with the tuck as with the resection; (c) postoperative adhesions are less with the tuck because less trauma is inflicted; (d) the tuck is a more simple procedure, whereas the resection is difficult; (e) resection of the superior rectus is not necessary to gain an adequate exposure with the tuck; (f) a paralysis would result if the sutures do not hold with a resection, whereas defective sutures with a tuck return the condition to its preoperative

state; (g) with a tuck, an over effect is easily remedied by removal of the sutures but becomes an almost impossible condition to rectify with a resection.

Because of these reasons, I favor the tuck operation. In my hands the final result is as satisfactory as the resection operation and there is much less danger of complications.

As yet, no definite rules have been established as to the amount of the effect produced. It may be said that a five-mm. tuck is the minimum that should be attempted, and a 10-mm. the maximum (the number of millimeters refers to the entire portion of the muscle tucked and not just to one side). The minimum tuck of five mm. could be expected to correct about five to seven prism diopters of deviation with eyes front, and an eight-mm. tuck, eight to 10 prism diopters of deviation in eyes front. The result is no more predictable in this than in any extrinsic muscle operation.

6. Background of experience

Although my experience in dealing with problems of surgery on the superior oblique is limited to a comparatively short period, certain data indicate at least some success. However, more data and a longer period of critical observation are needed before an accurate evaluation of surgical results can be made.

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STABILITY OF AQUEOUS SOLUTIONS COMMONLY EMPLOYED IN THE TREATMENT OF PRIMARY GLAUCOMA*

Part II. Drug passage†

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Drug passage

The passage of a drug into the eye is dependent upon certain physical properties of the cornea, the drug itself, and the vehicle in which the drug is administered. It is important to recognize modern concepts of corneal physiology, the differential solubility of the drug in various solvents, the polarity of the drug, and the effect upon corneal penetration of epithelial damage and iontophoresis.

Corneal physiology

Since the passage of dissolved material into the eye is primarily through the cornea[1,5,8‡] and because it is believed that selective penetration is permitted by certain layers of the cornea depending upon the fat or water solubility of the solute,[8] a thorough knowledge of corneal physiology

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becomes paramount. Cogan and his co-workers[26-29] have added enormously to our knowledge of the physiology of the cornea and have correlated with it the phase solubility of dissolved substances.

The epithelium and endothelium of the cornea act in much the same manner. The corneal stroma (including Descemet's membrane), however, behaves in nearly an opposite fashion.

The epithelium, and probably the endothelium, is permeable only to solutes which are fat soluble.[28, 29] It acts as an effective barrier to the passage of physiologic electrolytes since these are generally fat insoluble.[29] The epithelium and endothelium, thus, are effective selectively permeable membranes and, as such, prevent the transfer of salts[27] but offer no opposition to the passage of water in either direction.[28]

The corneal stroma (including Descemet's membrane) is permeable to substances which are water soluble.[28, 29] The stroma offers only slight resistance to the passage of salts, and no interference to the transfer of water.[26]

Phase solubility and the passage of electrolytes

Dissolved material in order effectively to penetrate the epithelium must be soluble in fats and to penetrate the stroma must be soluble in water. It is essential therefore if substances are to pass through the entire cornea that they possess biphasic solubilities, which implies the ability of existing in two forms, a water-soluble and a fat-soluble form.

The alkaloidal drugs and preparations derived from them constitute a large proportion of the substances employed in modern therapy.[67] Alkaloids are weak electrolytes, and, because the epithelium offers marked resistance to the passage of electrolytes, penetration is accomplished by varying the hydrogen-ion concentration sufficiently to change the degree of drug dissociation and thereby modify drug solubility.

Weak bases become progressively undissociated with a lowering of hydrogen-ion concentration (increasing pH) and in that way gain fat solubility. Weak acids become progressively undissociated and more fat soluble as the hydrogen-ion concentration increases (decreasing pH).

Weak organic electrolytes in the undissociated or free-acid or base form are fat soluble and varying water soluble; whereas in the dissociated or salt form, they are water soluble and generally fat insoluble.[29] For example, pilocarpine hydrochloride $C_{11}H_{16}N_2O_2HCl$ is the water-soluble salt form of the alkaloid of pilocarpine $C_{11}H_{16}N_2O_2$. The salt of pilocarpine in solution dissociates into pilocarpine ions and chloride ions as illustrated by the equation:

$$C_{11}H_{16}N_2O_2HCl \rightarrow C_{11}N_{16}N_2O_2H^+ + Cl^-.$$

In addition to dissociation the pilocarpine hydrochloride undergoes a certain amount of hydrolysis according to the following equation:

$$C_{11}H_{16}N_2O_2H^+ + H_2O \rightleftharpoons C_{11}H_{16}N_2O_2HOH + H^+$$

In this way the undissociated fat-soluble base of pilocarpine is formed. The previous equation indicates that the equilibrium concentration of free base is controlled by adjusting the hydrogen-ion concentration. If the solution is rendered more alkaline by removing hydrogen ions, there occurs a high equilibrium concentration of the fat-soluble free base. If the pH is decreased by adding hydrogen ions, the equilibrium concentration of free base is lowered and as a consequence the solution becomes less fat soluble and corneal penetration is reduced.

Since the passage of an alkaloid through the cornea depends upon its ability to exist in two forms, a water-soluble salt form and a fat-soluble base form, Kinsey[60] postulates that the transfer of such substances through the intact cornea proceeds in somewhat the following manner:

The alkaloid in the solution applied to the cornea is an equilibrium mixture of the free-base and salt forms by virtue of hydrolysis

of the salt form. The equation for the hydrolysis may be represented as follows:

$$R^+ + H_2O \leftrightarrows ROH + H^+$$

In this equation R^+ represents the positively charged ion of the salt form and ROH, the free base form of the alkaloid. Clearly, the relative proportions of the two forms will depend upon the pH of the solution. ROH diffuses through the epithelium because it is fat soluble. As ROH is removed from the solution in this way, more of it is formed by furthe hydrolysis of the salt according to the law of mass action.[124] Thus, the alkaloid will more or less completely gain entrance into the epithelium.

When the free base diffuses from the epithelium into the stroma, R^+ will be formed from it by a reversal of the above reaction. As R^+ diffuses away through the stroma, further conversion of ROH into R^+ occurs according to the law of mass action. In this way, the alkaloid penetrates the stroma.

At the endothelial border of the stroma, both R^+ and ROH will again be present in an approximate equilibrium mixture. Since the endothelium is lipid in character, the mechanism for passage of the alkaloid through it is the same as for through the epithelium. Thus, penetration of the cornea occurs because of the differing solubilities of the dissociated and undissociated forms of the drug.

Cogan and Hirsch[39] state that "the most important considerations for permeability are the dissociation constant and its bearing on fat solubility. The dissociation constant of the ideal alkaloid would be sufficiently low so that the alkaloid would be present in the completely undissociated state at physiologic hydrogen-ion concentrations."

Polarity

Swan and White[119] believe the relationship between polar and nonpolar components of the molecule is of great importance in determining the surface-activity and solubility characteristics of the compound.

A polar compound has asymmetry of molecular structure which favors water solubility, whereas a nonpolar compound has symmetry of molecular structure which favors fat solubility.[3] Benzene is a symmetrical compound and therefore nonpolar. The alkaloids and their derivatives have asymmetry of molecular structure and are, as a consequence, polar.

Surface activity also depends upon molecular structure. Certain organic compounds may be predominantly polar at one end of the molecule and nonpolar at the other end. Such molecules orient themselves as far as the cornea is concerned so that the nonpolar portion of the molecule is directed into the lipids of the cornea and the polar portion away from the cornea into the surrounding media. As a result, surface tension is reduced at the interfaces.

Swan and White[119] found that nonpolar and surface-active compounds penetrate more readily into the epithelium than into the exposed stroma and that polar compounds penetrate the epithelium less readily than the exposed stroma.

Friedenwald[40] states that too much emphasis has been placed upon whether a substance is polar or nonpolar. He pointed out that substances which are wholly polar have little power to penetrate the corneal epithelium and substances which are lacking in polar groups have very little power to penetrate the stroma. Friedenwald believes that only substances which combine the effects of polar and nonpolar groups have a chance of passing both phases of the cornea.

Care must, however, be exercised in the selection of a proper vehicle; for if it be aqueous and the drug highly polar and therefore hydrophilic, the compound will remain in the vehicle and corneal penetration will be at a minimum.

Alkaloids are polar compounds, but, because most show high surface activity,[39] their power of corneal penetration is excellent. Highly polar compounds such as choline and its derivatives are, however, ex-

tremely hydrophilic[116] and show little surface activity. They therefore penetrate the cornea poorly, unless placed in a lipid vehicle or in one containing a wetting agent.

Corneal damage

Injury to the epithelium and a consequent change in corneal permeability may be caused by chemicals, trauma, and wide variation in osmotic pressure. Highly water-soluble drugs in aqueous solution, such as the cholines, penetrate the intact cornea poorly. If, however, the epithelium is damaged by the use of a local anesthetic or even by gentle massage through the lids, increased penetration occurs. The passage of the drug into the eye and thence into the general circulation may be rapid, and, if the drug is toxic, untoward systemic disturbances may arise. This may occur particularly with carbachol if the topical use of the drug is preceded by the administration of tetracaine followed by tonometric measurement.[118]

The increased permeability of the cornea brought about by changes in the osmotic pressure of the vehicle is probably due to epithelial damage rather than induced osmotic pressure imbalance. This was concluded by Swan and White,[119] who found that strong hypertonic solutions temporarily lessened the penetration of a test substance from the vehicle into the cornea. Longer contact between the hypertonic solution and the cornea caused epithelial damage and increased penetration. Markedly hypotonic solutions favored penetration, whereas moderate variations in osmotic pressure had no effect on penetration. Most solutions are hypotonic and produce no damage to the corneal epithelium unless repeatedly instilled or used as an irrigating fluid.[118]

Iontophoresis

When an acid, base or salt, is placed in solution, the molecules of the electrolyte are instantly dissociated to varying degrees into oppositely charged ions. If a direct current is then passed through the solution, the positively charged ions (cations) migrate to the negative electrode (cathode) and the negatively charged ions (anions) travel to the positive electrode (anode). Electropositive drugs (those in which the cation is of therapeutic value) may be passed through the cornea into the eye by means of a galvanic current if the vehicle bathing the eye is made the positive pole and the eye the negative pole.

Electronegative drugs (those in which the anion is of therapeutic value) may be carried into the eye by galvanic current if the vehicle is made the negative pole and the eye the positive pole. Physostigmine sulfate and salicylate, neostigmine bromide, pilocarpine hydrochloride and nitrate, methacholine chloride, and carbachol chloride are electropositive drugs. Examples of electronegative drugs are sodium penicillin, sodium sulfacetimide, and bacitracin.[101]

The iontophoretic method of rapidly introducing high concentrations of a drug into tissues such as those of the eye has been well investigated by von Sallmann.[127–131] Swan[118] advises, as a vehicle for drugs "driven" into the cornea by iontophoresis, a four-percent aqueous solution of the 4,000 centipose type of methyl cellulose. He has observed, except for a transitory stromal opacity, little immediate effect on a cornea subjected to iontophoresis.

The vehicle

The active ingredient, if it is to remain stable and be immediately available to the eye in an active state and in known concentration, must be placed in a vehicle having buffer capacity, self-sterilizing and wetting properties, and no incompatibilities. Adjustment of the osmotic pressure may vary within rather broad limits and the excipient should have less attraction for the drug than has the cornea.

Buffer systems and pH

A proper pH and maintenance of the hydrogen-ion concentration of a solution are

necessary in order to maintain optimum physiologic activity and stability, to reduce irritability, and to create maximum corneal penetration. The pH of a solution is maintained by buffering. A buffer solution may be defined as one whose composition can be accurately reproduced and whose known pH cannot be materially affected by the addition of reasonable amounts of weak acid or alkali.

Cogan and Hirsch[39] state that tears have buffer capacity and they determine the hydrogen-ion concentration of weak solutions as soon as instilled. Friedenwald, Hughes, and Herrmann[41] believe that the corneal substance itself may have a slight buffering capacity. The maintenance of the pH of the original solution may therefore not be as important in its immediate effect on the eye as it is in maintaining solution stability.

The attention of ophthalmologists has been drawn to the importance of buffering a solution through the work of Gifford[43] and of Gifford and Smith.[44] Anhydrous boric acid, 12.4 gm., and anhydrous potassium chloride, 7.4 gm., are combined in 1,000 cc. of distilled water to produce what they termed acid buffer solution No. 1. The pH of this solution is 5.0. Boric acid was chosen because of its preservative qualities, and potassium chloride as a neutral salt because of certain synergistic properties.

A concentrate stock sodium carbonate solution containing 21.2 gm. of anhydrous sodium carbonate in 1,000 cc. of distilled water is compounded to add to the acid buffer solution No. 1 in varying small amounts. In this manner a final solution can be obtained with reactions from pH 5.0 to 9.0 depending on the amount of sodium carbonate added.

This buffer mixture of Gifford,[43] which is but a slight modification of that developed by Atkins and Pantin,[6] is incompatible with benzalkonium chloride and when used at a pH below 8.0 has a marked tendency to become more alkaline through giving off more carbon dioxide than it absorbs. If high buffer capacity is essential, the Gifford buffer should be used at a pH of 8.0 or above.[63]

The Palitzsch borate buffer according to Hind and Goyan[63] can be adjusted to be isotonic to physiologic saline by the method of Goyan, Enright, and Wells.[56] This is a dependable stable buffer but because of its high pH, 8.0 to 10.0, it can be used only for drugs where marked, short-lived, physiologic activity is desirable. Others[4, 25, 36, 41, 64] have developed or modified buffers but none carry the ease of compounding, so few incompatibilities, and so desirable a pH for so many ophthalmic drugs as does that of Hind and Goyan.[63] They modified Sorensen's phosphate buffer system[103] so that it has a buffer range from pH 5.8 to 8.0 with a maximum buffer capacity at pH 6.7. This buffer is a mixture of anhydrous sodium acid phosphate and anhydrous disodium phosphate so adjusted with sodium chloride to be isotonic to physiologic saline. This solution contains no ions foreign to the eye and is compatible with the preservative wetting agent benzalkonium chloride. The Hind and Goyan buffer system controls the pH at near the isohydric point of tears and maintains the active ingredient at a pH where it has moderate physiologic activity and stability.

The drugs utilized in making up a buffer solution must be chemically pure, anhydrous, and of reagent grade. The precautions that are necessary according to Gifford[43] are good scales, clean glassware, and pipettes measuring accurately to 0.10 cc.

The water employed need not be freshly distilled even though Truog[122] points out that Johnston found it took only about 10 minutes for unstirred water in an open beaker to come to equilibrium with the carbonic acid of the air. Truog[122] also quotes Kendall as finding that pure distilled water comes to complete equilibrium with the air at a pH of 5.6 to 5.8. He emphasized that pure water has no buffer capacity and that even minute amounts of impurities may be sufficient to alter markedly its pH. Gifford[43] boiled distilled water having a pH of 5.8 to drive off the CO_2 The boiled distilled water had a pH of 6.8 and when used in making up a buffer

the resultant buffer's reaction was nearly the same as was that made up with ordinary unboiled distilled water. Gifford concluded that the boiling refinement was not necessary.

Temperature variation produces little change in the pH. Clark[24] found, for example, that acid potassium phalate 0.05 m at 18°C. has a pH of 3.92 and at 60°C. a pH of 3.94.

Surface tension and wetting agents

Friedenwald[40] pointed out that most drugs which we are accustomed to use are of the surface-acting type, such as the alkaloids of physostigmine and pilocarpine. These alkaloids are able to penetrate the cornea "under their own steam," whereas other drugs such as carbachol, a water-soluble choline derivative, are devoid of surface-acting properties and therefore penetrate poorly. The penetration of such a drug may be enhanced by placing it in a vehicle containing a detergent or wetting agent. Ginsburg and Robeson[45] believe that detergents increase the penetration of drugs, possibly by "solubilising" the intercellular cement of the corneal epithelium.

Swan[113] describes wetting as the lowering of the surface tension of water by highly surface-active compounds, thereby facilitating the miscibility of water with water-soluble substances. Swan[113] believes wetting agents enhance the chemical effectiveness of drugs administered for intraocular purposes by at least two mechanisms: they (a) improve contact of a drug with the corneal epithelium by increasing the miscibility of the solution with the precorneal film and (b) directly influence the permeability characteristics of the epithelium.

Bellows and Gutmann[9] define a wetting agent as a substance which by lowering interfacial tension increases penetration and acts as a detergent or emulsifying agent.

Detergents increase the penetration of a drug only when applied to the intact epithelium. If epithelial damage has occurred, not only is the effect of the wetting agent nullified but, according to Leopold,[74] actual retardation of the regenerative power of corneal epithelium occurs. Swan[113] found the concentrations of wetting agents producing irritation in the conjunctival sac are usually greater than the minimal effective therapeutic concentrations, provided the solutions are not administered too frequently. He emphasized, however, that "the low toxicity of these agents have been unduly stressed by pharmaceutical manufacturers."

None of the detergents should be applied to the eye in high concentrations, frequently or for long periods. Aerosol OT,®[58] duponol,®[76] sodium propionate (proprion®[130]), phemerol,®[117] and benzalkonium chloride (zephiran®[84, 128]) have excellent wetting power,[117] are of low toxicity, and, the latter in particular, has a high bactericidal capacity.[78] Benzalkonium chloride[128] is especially satisfactory because it is freely soluble in water, is heat and cold resistant, has few incompatibilities and an approximately neutral pH, is a cationic agent, and is thus inactivated by anionic detergents such as soap.

Sterilization

Ophthalmic solutions become contaminated after being used only once or twice unless some means is employed to produce and continue the sterility of the solution.[50] Sterilization may be accomplished by mechanical filtration, through the use of heat, or by means of chemicals.[81] Passing a solution through a Berkefeld-type filter if the maximum pore radius is 0.85 micron removes even the minutest bacteria. Boiling, tyndallizing, or autoclaving a solution kills pathogenic bacteria but in doing so may reduce the physiologic activity of the drug. Such methods are also objectionable because the solution remains sterile only as long as it remains tightly sealed.

Ophthalmic solutions are usually dispensed in dropper bottles. The bottle is opened several times a day and its contents subjected to contamination by the dropper, which not infrequently touches the patient's hands, face, lashes, and lids. The ideal solu-

tion must therefore be self-sterilizing.

To produce such a solution, McPherson and Wood[78] believe there must be introduced some substance which "(1) is bactericidal, (2) does not react chemically or physically with standard ophthalmic drugs, and (3) is not irritating to the human eye."

Arrigoni, Tozer, and Fischer[5] believe that solutions should be kept at a pH near 6.7, inasmuch as many pathogenic bacteria cannot live in an acid medium. Buchanan and Fulmer[12] have found that the pneumococcus cannot live at a pH below 7.0 but that staphylococci and streptococci tolerate wide ranges of pH.

Gifford and Smith[44] found that fungi and bacteria did not grow in their buffer or if they did so this was exceptional. The experience of Hosford and Hicks[64] with the keeping qualities of the Gifford and Smith buffer indicated that some preservative should be added.

Numerous preservatives and antiseptics have been used in ophthalmic solutions. Boric acid retards the growth of fungi but does not destroy pathogenic bacteria once the solution is contaminated. Camphor and menthol and more recently chlorobutanol have been employed as preservatives. Hasler[58] found that chlorobutanol stings the eye, is poorly soluble in aqueous solution, and is precipitated at a pH of 7.5 or above.

Herrmann, Moses, and Friedenwald[61] have shown that chlorobutanol inhibits the oxygen uptake of the bovine cornea. Martin and Mims[77] concluded, since many therapeutic agents also inhibit the oxygen uptake of the cornea, that chlorobutanol should not be used as a preservative or as a buffer.

As a germicide and preservative, Hasler[58] advocated the use of the derivatives of benzoic acid, 65 parts Nipagin-m in combination with 35 parts Nipasol-m. As such, this combination is nontoxic and nonirritating to the eye but its preservative capacity has been challenged by Spengler and Kessler.[104]

Benzalkonium chloride (alkyl dimethyl ammonium chloride, zephiran®) is at present widely used as a means of rendering a solution self-sterilizing. This substance, derived from the fatty acids of coconut oil, in the solid is uniform in composition, soaplike in consistency, and amber in color. In aqueous solution it is slightly acid in reaction and has a surface tension of less than 36 dynes per centimeter. Neither freezing nor excessive heat reduce its germicidal action.[34] It is nontoxic[65] and compatible with most drugs except those having a salicylate or nitrate radical.[78]

According to Dunn,[34] it is the ammonia group which even in high dilution destroys gram-negative and gram-positive bacteria. Thompson, Isaacs, and Khorazo[121] found that a solution of alba (benzalkonium chloride) in a 0.04 percent concentration destroyed Staphylococcus aureus in one minute. They found this substance to stand up well under dilution, to be very rapid in action, but to injure lysozyme action.

Hughson and Stryon[68] found that 1:5,000 alkyl dimethyl ammonium chloride maintained the sterility of open bottles of 0.5 percent physostigmine and 1.0 percent pilocarpine for 19 days. McPherson and Wood[78] introduced Staphylococcus aureus, Escherichia coli, and Bacillus pyocyaneus into a 1:5,000 solution of benzalkonium chloride and found that none of the organisms survived after two minutes.

Benzalkonium chloride, of all of the substances employed, most nearly meets the ideal as a means of self-sterilizing an ophthalmic solution which will be used over a long period of time.

Compatibility

The ingredients of the Hind and Goyan[63] buffer and those of the Gifford[42] buffer are perfectly compatible with the miotic drugs commonly employed in the treatment of glaucoma. If, however, benzalkonium chloride is added to the buffer system certain incompatibilities arise. Benzalkonium chloride[100] is incompatible with the ingredients used in the Gifford buffer but not with those of

Hind and Goyan. Physostigmine salicylate and pilocarpine nitrate are incompatible with benzalkonium chloride.[78]

The incompatibility of soluble nitrates with benzalkonium chloride (alkyl dimethyl benzyl ammonium chloride) is probably due to the formation of insoluble alkyl dimethyl benzyl ammonium nitrate.[66] This unstable incompatible solution shows a colloidal white precipitate. The degree of incompatibility depends upon the character and concentration of nitrate used. For example in the case of pilocarpine nitrate containing 23.25 percent nitrate ion, precipitation is produced with 1.7 percent pilocarpine nitrate. The faint white cloudiness produced by the precipitate of ammonium nitrate and nitric acid disappears when the solution is warmed to 35°C.[66]

Inasmuch as it is usually advisable to incorporate benzalkonium chloride in the buffer system in order to add wetting power and self-sterilization to its properties, pilocarpine nitrate and physostigmine salicylate must be avoided and the Gifford buffer cannot be used.

Isotonicity

Isotonicity implies that the ophthalmic solution and tears have the same osmotic pressure. The accurate determination of osmotic pressure is technically difficult and, because of this, resort is usually made to one of the more easily measured colligative properties of a solution such as depression of the freezing point.[132] Since the information obtained by the measurement of any one colligative property can be applied to the other colligative properties of a solution, it is evident that solutions which freeze at the same temperature are isotonic. Brecht[11] gives the average freezing point of tears as −0.80°C. and Duke-Elder[30] as −0.600 to −0.9566°C.

The concentration of a solution may be expressed in terms of the percent strength of sodium chloride solution which freezes at the same temperature. This is referred to as the sodium chloride equivalent of the solution. Duke-Elder[30] gives the sodium chloride equivalent of tears as 1.32 to 1.427. Ridley,[68] however, found tears to be nearly isotonic with 0.9-percent sodium chloride, as did Krogh, Lund, and Pedersen-Bjergaard.[72]

It has been considered important to adjust a solution so that it is isotonic with tears. This was deemed advisable in order to obtain better penetration of the drug in solution and to avoid irritation and damage of the ocular tissues.

Hind and Goyan,[68] however, found that solutions may be well tolerated even though their freezing point values vary from −0.331 to −1.244 or, in terms of sodium-chloride equivalent, from 0.5 percent to 2.0 percent. They also determined that the eye can tolerate well a wide change in osmotic pressure when the pH is controlled but can also tolerate without apparent irritation a wide change in pH if the osmotic pressure is controlled.

Krogh, Lund, and Pedersen-Bjergaard[72] found that trained observers could distinguish between the irritating sensations of 0.6- and 2.0-percent sodium chloride solution placed at the inner corner of the eye, but that untrained observers could tell no difference between the 0.6- and 2.0-percent concentration. They concluded that the normal eye is no doubt rather insensitive to concentration differences.

Martin and Mims[77] state that any solution instilled in the conjunctival sac which has a tonicity equivalent to a 0.9- to 1.4-percent solution of sodium chloride is acceptable. They believe that from simple clinical observation it is evident that an even wider range of tonicity than the 0.5- to 2.0-percent as suggested by Swan is safe for clinical use. They further state that whereas the pH may be maintained by buffering, the tonicity is often changed by the addition of the desired drug.

Swan[115] has found that the commonly used drugs are hypotonic, but, owing to the protection and diluent action of the conjunctival secretion, even highly hypotonic solutions do not produce annoying sensation or alteration in the corneal epithelium unless

repeatedly instilled or used in irrigation. Swan and White[119] observed that strong hypertonic solutions produced epithelial damage upon prolonged contact with the cornea. Swan[115] says that the addition of nonmedicament solutes to make ordinary eyedrops isotonic is unnecessary and increases the danger of the pharmacist making an error in the preparation of the prescription.

If for some reason it is imperative that the osmotic pressure be accurately adjusted, reference may be made to Nicola's tables[83] or to the isotonic collyria preparation method as developed by Mellen and Seltzer.[80] Hind and Goyan emphasize that "the lacrimated tear should not be the basis for determining the tonicity of the ophthalmic solution but that an osmotic effect equal to physiological saline should be sought."

Sprowls[105] has compiled a table which shows the amount of water necessary to dissolve that amount of the drug which will give a 1.0-percent concentration in the final solution when a stock buffer solution is added to make 30 cc. A desired known tonicity is thereby obtained.

Martin and Mims[77] suggest that a phosphate buffer solution be prepared so as to have a 0.9-percent sodium chloride equivalent. Then therapeutic amounts of all drugs recommended for use in it can be added without exceeding an accepted upper limit of 1.4-percent sodium chloride equivalent.

Relative affinities

The relative affinity of solute for solvent has direct influence upon the amount of drug readily available for passage into the eye. If a water-soluble compound is administered in an aqueous vehicle, corneal penetration is interfered with, inasmuch as the substance is hydrophilic and therefore tends to remain in the vehicle. A fat-soluble compound, however, if placed in an aqueous vehicle readily leaves the aqueous vehicle and joins the lipids of the cornea.

Swan[116] recognized the principle of the distribution of solutes between immiscible solvents[122] and referred to these tendencies as the law of "relative affinities." His definition is as follows: "When a medicament is placed in the conjunctival sac, the distribution of the drug between the drug vehicle and the tissue is generally in accordance with the relative affinity of the drug for the vehicle and for the tissues."

In general, therefore, hydrophilic compounds such as choline and its esters should be placed in an anhydrous vehicle such as castor oil or in an ointment with an anhydrous base. On the other hand, if a compound has a high affinity for oil, it should be administered in an aqueous solution for which it has less attraction than for the lipid elements of the cornea.

Solution stability

The ester linkages in most physiologic active bases undergo hydrolysis and decomposition in neutral or alkaline solutions.[63] The stability of a solution is therefore directly related to its hydrogen-ion concentration. Hind and Goyan[63] point out that the pH required for optimum activity may not correspond with the pH necessary for utmost stability. Some physiologic activity may therefore have to be sacrificed in order to bring about solution stability.

Pilocarpine at a pH of 2.0 to 3.0 is very stable but has a minimum physiologic activity. Hind and Goyan[63] maintained pilocarpine hydrochloride solution at 90 to 100 degrees centigrade for an hour. This supposedly simulated the hydrolysis and oxidation that would have occurred if the solution had stood for 30 days at room temperature. They found that a 1.0-percent solution of the pilocarpine showed less than 10 percent decomposition at a pH of from 3.0 to 6.8, and at a pH of 7.4 over 20-percent decomposition occurred. The amount of pilocarpine solution decomposition was determined by washing the solution with chloroform and ascertaining the amount of pilocarpine recovered.

Blok[9, 10] found that the rotation of 2.0-percent pilocarpine hydrochloride in a 2.5-percent boric-acid solution was unaltered

after being kept for six months at room temperature. A sterile solution of pilocarpine hydrochloride in distilled water was found, by studying its rotation, to have decomposed only slightly after five and a half years. A pilocarpine solution with a pH of 8.2 was then examined by Blok. He found that the rotation of the solution after six weeks was diminished from +92.5 degrees to +51.0 degrees. The solution was shaken five times with chloroform to withdraw from it the pilocarpine base. It was found that 55 percent of the base had been taken up with the chloroform.

The pharmacologic action of the six-weeks-old pilocarpine was then determined by instilling some of the solution into the eyes of human beings and cats and observing the pupillary response compared to that of a fresh solution diluted to 75 percent. Blok estimated that the six weeks' old pilocarpine solution had decomposed by about 15 to 25 percent. He found after similar tests with a two months' old alkaline pilocarpine solution a 35 to 45 percent decomposition. Blok[9] concluded that alkaline pilocarpine solution should not be kept longer than six weeks, whereas pilocarpine in boric-acid solution was stable for an almost unlimited time.

The decomposition of physostigmine is due to oxidation and hydrolysis. Temperature, light, and pH are factors which vary its rate of decomposition.[63] Salway[58] has represented the decomposition of solutions of eserine as follows:

$$\underset{\text{eserine}}{C_{15}H_{21}O_2N_3} + HOH \rightarrow \underset{\text{physovenine}}{C_{13}H_{18}O_2N_2} + \underset{\text{methylamine}}{CH_3NH_2}$$

$$\underset{\text{physovenine}}{C_{13}H_{18}O_2N_2} \rightarrow \underset{\text{eseroline}}{C_{12}H_{16}ON_2} + CO_2$$

Physostigmine solution when it oxidizes turns pink and becomes extremely irritating, probably due to the formation of methylamine.[63] Gifford and Smith[44] have pointed out that solutions of physostigmine turn red more quickly in alkaline than they do in saturated boric-acid solutions and that the change of color does not reduce the physiologic activity of the solution. They found that acid solutions a month old were much less effective than fresh acid solutions and that alkaline solutions lost some of their effectiveness after a month. It was observed, however, that an old alkaline solution of physostigmine was still more active than a freshly prepared acid solution.

Martin and Mims[77] believe that, even though red physostigmine is still active, a more stable solution would be less irritating and more effective therapeutically. Hicks[62] blames the development of the red unstable physostigmine solution on an oxidation process, inasmuch as this development can be controlled by adding a reducing agent to the solution. Such an agent, sodium formaldehyde sulfoxylate, a harmless, nonirritating, reducing substance, has been used by Krantz, Carr, and Musser[79] in solutions of physostigmine to prevent the development of an unstable red solution.

Sodium formaldehyde sulfoxylate is used in a concentration of 1:5,000 in phosphate buffer at a pH of exactly 6.2. Any variation from this pH will cause solution deterioration, irritation, and the development of an alliaceous odor. Solutions of eserine having a pH of 5.0 or less are quite stable and produce little irritation. At this pH, sodium formaldehyde sulfoxylate decomposes into formaldehyde and formic acid.

Another antioxidant, sodium metabisulfite, is not particularly sensitive to hydrogen-ion concentration change and has been found by Hind and Goyan[63] to be an excellent means of stabilizing eserine. Martin and Mims[77] found that sodium bisulfite is more generally available than sodium metabisulfite and is equally effective in keeping eserine stable. Eserine solutions containing sodium bisulfite were clear and white after five months even though the bottle tops had been loosened periodically and the contents agitated. Over a four-month period no color change was seen.

As a comparison, one percent eserine was placed in buffer solution alone and oxidation occurred in 20 days. Eserine placed in dis-

tilled water oxidized immediately, a pH of 2.8 was reached in six days, and a pH of 2.0 in less than 20 days.

Physostigmine, therefore, develops a red color and becomes intensely irritating as the solution becomes unstable upon standing in an alkaline medium. Eserine solutions of a pH of near 5.0 and containing sodium bisulfite do not develop color or become irritating and remain stable for long periods. An accurate determination of loss in physiologic activity over a period of time has not been done.

Hind and Goyan[65] found that if prostigmin® (neostigmine) hydrobromide was dispensed at a pH of 7.4 there occurred a high concentration of free base at equilibrium with the salt. As a result, the solution was unstable and highly irritating. At a pH of 5.0 the solution became stable and nonirritating. This agrees with Burger,[20] who wrote that a solution of prostigmin is not hydrolyzed if buffered at a pH of 3.0 to 4.0. No reference was found as to the percentage decomposition of neostigmine that occurs with time.

The manufacturer[79] of mecholyl® (methacholine chloride U.S.P.) recommends using freshly prepared aqueous solutions of this drug because its stability and activity over a long period of time have not been definitely determined. Scheie[96] states that "mecholyl is used in aqueous solutions which, however, are unstable and cannot be kept for long periods of time." Since mecholyl is an analog of acetylcholine,[12] one may assume that it undergoes quick hydrolysis in alkaline solution and is therefore more stable in an acid medium.

O'Brien and Swan[84] found that doryl® (carbachol U.S.P.) loses little potency with boiling and remains pharmacologically active for one year at room temperature. Burger[14] states that doryl® in aqueous solution is stable on boiling and sterilization. Mention was not made of the means by which O'Brien and Swan and Burger determined doryl's stability.

Care must be exercised in the choice of buffers, inasmuch as miotics are usually unstable in alkaline media. The Gifford buffer in particular becomes more alkaline upon standing, as it gives off more CO_2 than it absorbs from the air.[63]

The amount of active ingredient in a solution may be determined by chemical assay or by biologic assay. Quantitative alkaloidal chemical analysis is extremely difficult, particularly when dealing with small quantities and mixtures of substances. There is a lack of specificity in alkaloidal chemical reactions, and as a result of the difficulties encountered such determinations are seldom carried out.

Biologic assay is a simpler and more accurate method of analysis. By this method the amount of miotic drug in solution capable of inducing physiologic response may be determined. This may be accomplished by measuring pupillary and accommodative change, variations in intraocular pressure, and contraction of the isolated iris sphincter.

A variation in pupil size is most accurately measured by photography, providing the picture is taken during the latent period of pupillary response to light.

The use of the isolated iris sphincter offers a sensitive and accurate way of evaluating the physiologic activity of miotics. The effect of drugs on the isolated iris has been investigated by Poos,[86] Velhagen,[126] Heath and Geiter,[59] Heath and Sachs,[60] and Sachs and Heath.[93, 94] It has been pointed out by Guyton[57] that the transfer of in vitro data to a consideration of the living eye is subject to criticism but that the qualitative reaction of isolated muscles should not differ from their actions in the intact eye.

While there is some exact knowledge as to the stability of miotic solutions commonly employed in the treatment of glaucoma, information is lacking as to the percentage of decomposition that these solutions undergo while at the pH and in the vehicle in which they are ordinarily prescribed.

Experimental work was carried out noting the effect of certain commonly employed

miotics on the isolated iris sphincter of the rabbit and human being and upon the pupillary size in human subjects. The miotics had been stored for various lengths of time and under conditions of extremes in temperature. Each drug was placed in the vehicle in which it is prescribed in clinical practice.

To be concluded

Complete references for this paper will be found on pages 397-400, March, 1954.

CLINICAL PATHOLOGIC CONFERENCE

From the Laboratory of
PARKER HEATH, M.D.
Boston, Massachusetts

CASE E 51-515

HISTORY

A man, aged 68 years, 23 years before had had an extraction of a senile cataract from the right eye. Four years later he returned with secondary glaucoma in this eye. A trephining operation was done.

Eight years later the patient was admitted to hospital for pain in the left ear. This time he gave a history of tuberculosis years before. A chest film done at this time showed tuberculosis at both apices, excessive fibrosis, and contraction of both upper lobes. Two sputum smears were negative.

He had a surgical procedure for otitis media with mastoiditis, including a paracentesis. Culture from the ear proved Staphylococcus aureus.

Five years later the patient appeared with congestion and inflammation—uveitis—in the aphakic right eye and secondary glaucoma. He was admitted to the hospital and a paracentesis and needling of the pupillary membrane, O.D., were done. His intraocular pressure remained elevated. Four days later a trephining operation was done on the same, the right eye.

One year later the patient appeared at which time he gave the history here summarized: In the beginning he had an inflammation in the right eye causing a cataract, the latter was removed and then glaucoma developed for which he had the three operations already described. He was now admitted for a fourth operation to correct the elevated intraocular pressure. On the following day a trephining operation was done on the right eye.

Five years later the man again appeared stating that the right eye had been blind for years and that it was now red and quite painful.

EXAMINATION

There was no light perception in the right eye. Vesicular and bullous keratopathy was present. The corneal epithelium was loose. There was a hearty congenital limbus and some pannus. Intraocular pressure was: O.D., 48 mm. Hg; O.S., 20 mm. Hg (Schiøtz). Transillumination was not contributory. A general physical examination gave essentially normal findings.

TREATMENT

Since the right eye was blind and painful, enucleation was advised and accepted.

DIFFERENTIAL DIAGNOSIS

DISCUSSION BY DR. K. RIEMER*

The outstanding features of this patient's history are the long record of the course of the ocular disease, the many surgical interventions, and last but not least the remarkable loyalty of the patient. The span between the initial cataract extraction and the glaucomatous exitus is 23 years. One cataract extraction, one paracentesis and needling, three trephining operations upon one eye

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before it was enucleated is a record, not to mention the otitis media procedure linked with a paracentesis of the ear drum and a mastoid operation. The patient succeeded in establishing a five-year average interval between his treatments. It is notable that the whole process remained unilateral.

As we proceed through the diagnostic lanes and by-passes in this case, one fact stands out—a unilateral cataract involvement usually means a complicated type. Our search for a diagnosis therefore lies in the field of this complication in a man, aged 45 years. We are not informed as to his history prior to the initial, unilateral cataract operation. No hints of familial disease or of occupational or other injury are given.

After the cataract operation, he did fairly well for four years before the first glaucoma surgery was indicated. Possible help for us could have been supplied by technical details: Was the intraocular pressure elevated before the operation? Was the extraction an extracapsular type because of complications? Did the chamber remain flat for a considerable time afterward? Were there any hemorrhages in the anterior chamber? Was there any evidence of capsular flaking?

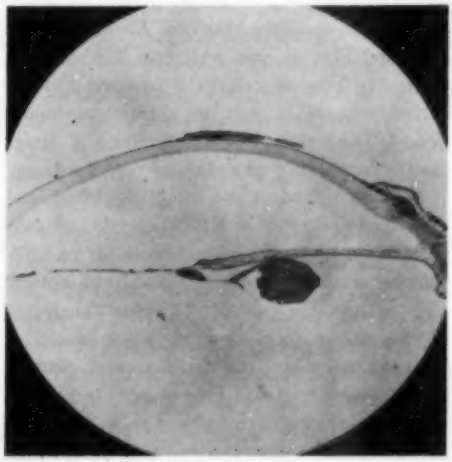

Fig. 1 (Heath). Anterior segment: bullous keratopathy, healed and closed trephination bleb, pupil membrane over iridectomy, anterior synechia over angle, calcified lens remnant.

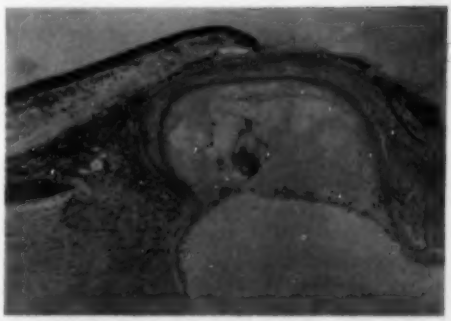

Fig. 2 (Heath). Last of three trephination blebs with hyaline and fibrous membrane closure.

Tuberculosis existed 11 years before enucleation, according to X-ray study but without positive sputum. An otitis media was treated; smears from the ear cultured Staphylococcus aureus. I am inclined to discount the lung lesion as of limited ocular importance. The course taken by his uveitis, the time intervals, and the meager clinical findings reported do not suggest much activity in the uvea. However, the excessive fibrosis reported in the lung hints that a chronic fibrosis is this patient's response to one kind of inflammation.

This hint could be used in making the ocular diagnosis. The patient "does too well," the intervals between necessary surgical relief are too long to indicate that the surgery was inadequate. But some sort of fibrosis might well explain the relatively limited and short duration of the lowered intraocular pressure following the several trephinations. I am inclined to think this is the probable explanation of the closing off of the limbus escape-valve.

Another explanation for his recurrent glaucoma is that of epithelization of the anterior chamber. This is unlikely since the symptom-free intervals between bouts of glaucoma are too long and there is no objective evidence to suggest it.

Tumor is a consideration, only to be discarded upon the evidence supplied. Twenty-three years is too long a period for an intraocular neoplasm to escape diagnosis, and the

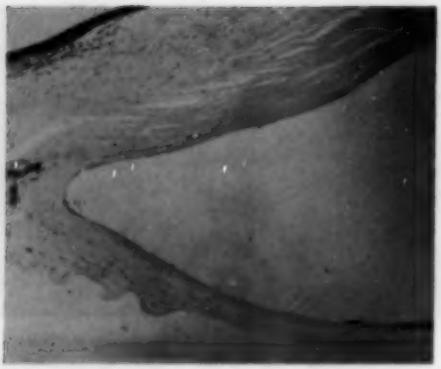

Fig. 3 (Heath). Long arm of exuberant fibrous tissue extending into anterior chamber from site of needling perforation.

uveitis described is relatively indolent, unlike that due to a necrotic tumor.

Differential diagnosis begins with the cataract operation upon an eye long before afflicted with uvetitis. The patient's cyclitic cataract was removed, probably from a bed of iris synechia. Whether extraction was done in the capsule, as seems unlikely, or extracapsularly, as seems probable, the low-grade slumbering uveitis was activated. In due time anterior synechia formed, and there was secondary glaucoma due to angle-block. Relief was obtained by a trephining operation. Fibrosis successively closed off and rendered useless the drainage valves. After the third round, trephination lost the bout to fibrosis.

Diagnosis

Clinical diagnosis. Cataracta complicata; late secondary glaucoma.

Dr. Riemer's diagnosis. Uveitis, cataracta complicata, secondary glaucoma.

Pathologic diagnosis. The principal features are:

1. Low-grade uveitis, old and recurrent.
2. Marked atrophy of the uvea and retina.
3. Bullous keratopathy.
4. Aphakia with calcified lens remnants.
5. Corneal perforation, exuberant fibrous repair.
6. Anterior synechias obstructing angle and secondary glaucoma.
7. Trephination bleb obstructed by fibrous membrane.
8. Late atrophy of optic nerve and glaucomatous cupping of nervehead.

Comment by Dr. Parker Heath

As Dr. Riemer had predicted laboratory examination showed the atrophies of recurrent uveitis of low-grade intensity coupled with those of glaucoma.

"Which came first?" is a fair question.

The atrophies have an extensiveness with loss of ganglion cells suggesting glaucoma. The inflammatory and repair signs suggest low-grade recurrent processes. Both glaucomatous and inflammatory atrophies have existed long enough to prevent diagnostic assertions regarding priority.

The cataract operation was done extracapsularly. Capsule remnants are numerous with some in the cornea, and a substantial calcified remnant of lens cortex lies behind the iris. Nothing found suggests that a state of lens sensitivity or phaco-anaphylaxis existed. However, the lens remnants (post-cataract operation) could have influenced unfavorably a low-grade uveitis.

The cornea presented a well-marked vesicular and bullous keratopathy. In addition, an unusually exuberant fibrous repair extended like an arm well into the anterior chamber. This was largely covered by endothelium and, in part, by a cuticular membrane. The process probably derived from the perforation of paracentesis and needling.

X-ray studies of the lung suggested unusual fibrous repair in a tuberculosis process. Similar ocular evidence comes from the fibrous closure of the several trephination blebs and the cornea-anterior chamber fibrous extension is along the same line. The patient repairs his inflammations and wounds by excessive fibrosis. This mesodermal trait is encountered occasionally in the white race and more commonly in the Negro race. More successful in the surgical treatment of glaucoma in these patients is diathermy on the ciliary body.

243 Charles Street (14).

NOTES, CASES, INSTRUMENTS

EOSINOPHILIC GRANULOMA INVOLVING THE ORBIT

REPORT OF A CASE

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A report of eosinophilic granuloma of bone first appeared in the literature in 1940 when Lichtenstein and Jaffe[9] described such a case as a new and distinct entity.

The number of reported cases of this disease is not large. The pathologic process is usually found in a rib, long bone, or skull. Primary orbital involvement is apparently rare, although there are numerous cases reported as involving the frontal bone.

The only case with orbital involvement in the American ophthalmic literature, presented by Wheeler,[16] was that of a 34-year-old man with exophthalmos. Gross and Jacox[7] cited one other patient with exophthalmos. Beller and Kornbleuth[1] have reported two cases in the British literature.

Pfeiffer,[13] in 1943, reviewed 200 successive cases of exophthalmos from a radiologic aspect and not one was due to eosinophilic granuloma. Forrest,[3] in 1949, reviewed 222 cases of intraorbital tumor at the Army Institute of Pathology and listed no eosinophilic granuloma. Spaeth[15] in 1951 reported on 170 ocular tumors, including orbital tumors, none of which was eosinophilic granuloma. Fralick[4-6] in his annual review of the orbit lists three articles in the foreign literature describing eosinophilic granuloma.

One patient described by Beller and Kornbleuth[1] had blurring of vision of two weeks' duration which progressed rapidly to seeing only hand motions. The patient had a proptosis of five mm. Eye movements were limited in all directions. Their second case showed a progressive proptosis of eight months' duration and a reduced pupillary reation to light on the affected side. The lesion was tentatively diagnosed as a dermoid cyst and removed surgically. Histologic examination proved it to be an eosinophilic granuloma.

Wheeler's[16] patient showed an exophthalmos of two mm., with four mm. of downward displacement. There was no limitation of motion nor was a palpable mass present.

Lichtenstein and Jaffe,[9] in their original article, reported eosinophilic granuloma to be a well-localized single lesion which tended to expand slowly and to erode bone in a manner suggestive of a malignancy. Reese[14] states that the lesions may be multiple.

The etiology of the disease is uncertain. Otani and Ehrlich[12] found injury to precede the development of the disease in two of the four cases they presented and felt that trauma may have been a predisposing factor. Others have expressed the belief that the lesion may be an inflammatory reaction caused by a virus. Cultures taken from the lesions have failed to reveal a causative organism and animal inoculations have been negative.

The disease process is generally ushered in with pain, tenderness, and swelling of only a few weeks' duration. There are usually no symptoms or signs of generalized illness other than an occasional slight fever or mild leukocytosis. Some cases show an eosinophilia of from four to 10 percent.

Secondary lesions may provoke no symptoms and may be found by incidental X-ray examination. The disease occurs most commonly during the first two decades of life with the extremes of two and 50 years according to Wheeler.[16] Beller and Kornbleuth[1] believe it is more common in males.

X-ray examination reveals a radiolucent zone which is rather sharply demarcated indicating a destructive lesion and giving the appearance of a malignancy. There is little evidence of reactive bone formation at the margin of the defect.

The disease is considered to be a lipoidosis;

however, blood cholesterol, cholesterol ester, and total lipid levels are within normal limits.

The disease is apparently self-limited and, in those cases with surgical exploration and curettement, the lesion heals rapidly without further increase in size. X-ray therapy to the lesion may also bring about resolution; however Reese and Lichtenstein and Jaffe state that it may heal spontaneously.

The process is thought to be a disorder of the reticulo-endothelial system. Farber,[5] Green and Farber,[6] Gross and Jacox,[7] Jaffe and Lichtenstein,[8] and Mallory[10-11] believe that the disturbance is related to Hand-Schüller-Christian disease and to Letterer-Siwe disease. They contend the three are variations in degree of the same underlying pathologic change, with eosinophilic granuloma the most benign and Letterer-Siwe disease the most severe, the latter usually terminating fatally.

Pathologically, the lesion is essentially a granuloma, and may be fairly well circumscribed. It is composed of large pale histiocyte cells or phagocytes that may be in a recticular arrangement. Scattered throughout are found many leukocytes, the more conspicuous being the eosinophils. The relative proportion of eosinophils may, however, vary some with the age of the lesion.[6] Multinuclear giant cells with a granular cytoplasm are usually seen also. In addition, there may be products of destruction such as necrotic debris, blood and blood pigment, and broken-down fragments of bone.

Report of case

History. G. C. a boy, aged five years, was first seen on October 9, 1951. His mother stated that she noticed a slight swelling and redness of the left upper lid about September 20, 1951. This swelling gradually increased until the palpebral fissure was nearly closed.

Dr. Charles Tompkins, a pediatrician, saw the child at that time and found nothing of significance except the swelling of the lid. There had been no elevation of temperature and no similar previous episode of lid swelling. In May, 1950, the patient had been struck in the left supraorbital region with a coal shovel; there was a small scar, about four cm., above the brow.

During the last part of September, 1951, while on a vacation trip, the left upper lid became more swollen causing closure of the palpebral fissure. A local physician was consulted who thought that there was a cyst in the upper lid and prescribed heat and the use of an ointment. Following this, the mother thought the swelling gradually decreased.

Eye examination. The patient's initial vision was: R.E., 20/20; L.E., 20/30. The left upper lid was swollen and presented a 10 by 15-mm. mass just below the superior orbital rim. The mass was tender and quite firm. The preauricular node on the left was palpable and tender. The bulbar and palpebral conjunctiva appeared normal. No proptosis or limitation of movement was present. The pupils were round and of normal size and responded actively to a light stimulus.

Three days later the patient was again seen at the office at which time the left upper lid continued to be swollen, red, and tender. The lesion resembled an abscess and at one spot appeared ready to perforate the skin. The patient was seen regularly for several days and continued the use of local treatment at home. The lid remained red and swollen and it was decided that the child should be hospitalized for further investigation and possible exploration and biopsy of the mass.

Physical examination revealed no positive findings other than the swelling and tenderness of the left upper lid.

Laboratory. The leukocyte count was 11,000 per c.mm., with 59-percent neutrophils, one-percent staff, two-percent eosinophils, and 38-percent lymphocytes. The erythrocyte count was 4.61 million per c.mm. with a 12 gm. of hemoglobin per hundred cc.

The urinalysis revealed a sediment with one or two white blood cells per field but was otherwise normal.

The *X-ray report* of Dr. Ralph Moore is as follows: "There is a lobulated oval radiolucent area of destruction of the left frontal bone and supraorbital region measuring three cm. in length (fig. 1). This has destroyed the inner two thirds of the superior bony margin of the orbit. The outlines are slightly hazy but fairly well demarcated. The inferior border of the lesion appears to extend onto the superior bony plate of the orbit formed by the supraorbital extension of the frontal bone."

The impression was a "solitary bone-destructive neoplasm of the left frontal bone extending into the roof of the orbit." This, according to Dr. Moore, could be due to an eosinophilic granuloma, dermoid, or solitary metastasis.

X-ray examinations of the kidneys and adrenal areas for calcification due to possible adrenal tumor or neuroblastoma were negative. A kidney, ureter, bladder X-ray examination was also normal.

Consultation with a neurosurgeon was requested because of the possibility of intracranial extension. Dr. Alister Finlayson reported as follows: "The location of the expanding lesion appears to be anterior to and above the globe, probably primarily a lesion arising within the frontal sinus or the diploe of the frontal bone, therefore it may be (1) mucocele, (2) eosinophilic granuloma, (3) dermoid, (4) giant-cell tumor. I believe that an intracranial approach is unwarranted and unnecessary but will attend surgery and scrub in if intracranial extension is present."

Because of the possibility that the lesion was arising primarily in the frontal sinus and extending into the orbit, an otorhinolaryngologist, Dr. T. T. Smith, was asked to see the child and concurred in the possible sinus involvement. On October 30, 1951, the patient was operated upon by Dr. Smith and me.

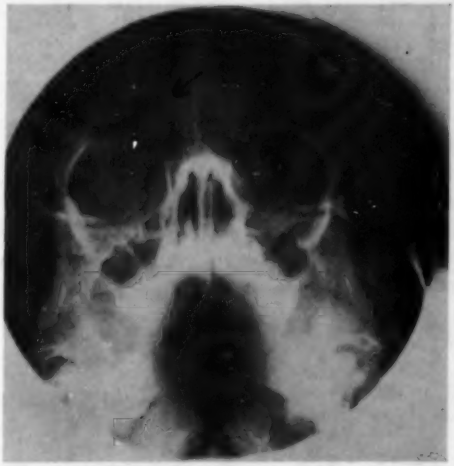

Fig. 1 (Truhlsen). Note oval, radiolucent area of destruction in frontal bone (arrow).

Operation. A linear incision was made from the bridge of the nose extending over the lid involvement to the lateral aspect of the orbit. A capsule covering a mass of soft, friable, reddish-brown tissue was encountered superficially. A biopsy was taken for a frozen section.

The capsule was followed back to the frontal bone at which point it was found to involve the bone superiorly and medially for a distance of approximately two cm. The frontal bone edge was irregular and roughened. The tumor was also followed backward to the inner table of the frontal bone where it had destroyed part of the inner table at one point and left the dura protruding. Inferiorly, the tumor extended back past the equator of the globe toward the orbital apex. The tumor was followed posteriorly as far as possible and all grossly visible tumor was removed.

It was not possible to remove all the lesion from the apex of the orbit. The roughened bone was curetted in the region of the frontal sinus after which the incision was closed with one drain. The frozen section taken during surgery was reported as malignant tissue probably of adrenal origin.

Pathologic report. The report of the par-

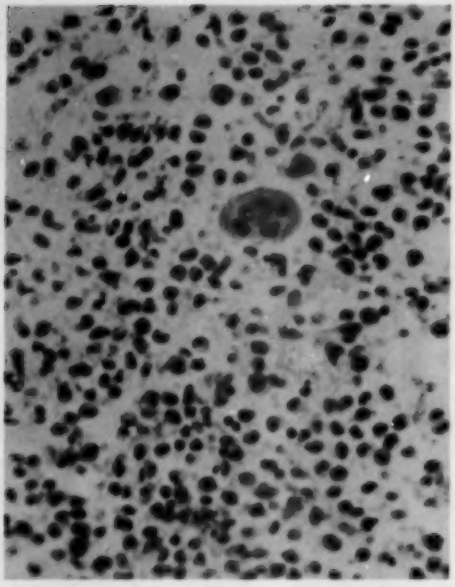

Fig. 2 (Truhlsen). Note multinuclear giant cell and diffusely scattered polymorphonuclear leukocytes many of which are eosinophils.

affin sections (fig. 2) by Dr. J. R. Schenken is as follows:

"The microscopic findings in the typical diagnostic areas consist of large sheets of closely packed cells supported by very little stroma and a moderate number of rather thin-walled blood vessels. The cells are macrophagelike cells which are about two to four times the diameter of a red cell.

"The cytoplasm is neutrophilic and the cytoplasmic border in the closely packed areas is indistinct. In the loosely dispersed areas, the cytoplasmic margins are fairly sharp although some show serrations and delicate streamers.

"The nuclei are centrally located, usually about one-half the total diameter of the cell. They have a fine powdery-blue appearance in the hematoxylin and eosin section. The shape is quite variable, varying from a rounded to an almost polylobular nucleus. Some of the nuclei are distinctly kidney shaped. Many of the nuclei show what appears to be chromatin bars but these, in effect, are ridges produced by rather large indentations.

There are scattered multinucleated giant cells containing nuclei similar to the single nucleated cells. Distinct nucleoli are present in the larger cells but this is not a common feature. A moderate number of mitotic figures are present, some of which are abnormal. The nuclei usually are less than 10 in number.

"Eosinophils are scattered throughout in small numbers and in an occasional small collection. They do not constitute a prominent feature, as is seen in some cases of eosinophilic granuloma although as many as 40 to 50 are occasionally seen in a high-power field.

"Other histologic detail consists of large sheets of necrotic cells and a capsular tissue which shows focal points of invasion by the granuloma cells. This capsular tissue consists of dense scar tissue in some areas and, in others, scarred skeletal muscle. The entire histologic picture is considered typical of eosinophilic granuloma of bone."

X-ray therapy. From November 2 through November 9, 1951, the patient was given X-ray therapy over the left supraorbital region, 144 r every other day for four days. On January 8, 1952, the radiologist stated that X-ray films showed no appreciable change or evidence of recurrence of the lesion.

Course. The tumor has shown no tendency to recur to date, although a left hypertropia gradually developed, presumably due to cicatricial changes in the superior portion of the left orbit. As the hypertropia progressed, a definite head tilt to the right became manifest. With the head tilted, the patient was able to fuse and, on turning the head to the primary position, diplopia resulted. Bielschowsky's sign was found to be positive. A weakness developed in the right superior rectus muscle due to inhibitional palsy.

The left hypertropia gradually increased to 30 prism diopters. Because of this the child was re-admitted to the hospital and on May 5, 1952, an unsuccessful attempt was made

to free the belly of the superior oblique muscle from the surrounding cicatricial tissue. It was possible, however, to take a tuck in the tendon of the left superior oblique. This resulted in approximately 10 prism diopters of correction.

A second operation was performed on July 9, 1952, consisting of a three-mm. recession of the right inferior rectus muscle and myomectomy of the left inferior oblique muscle. This resulted in one to two diopters of left hyperphoria which did not prevent fusion in the primary position.

Conclusion

Although extremely rare in an ophthalmologist's practice, eosinophilic granuloma should be considered in the differential diagnosis of cases of unilateral exophthalmos or unilateral lesions causing destruction of a portion of the bony orbit.

Findings which indicate the possibility of eosinophilic granuloma are: its rapid development with pain and tenderness in a person usually under 20 years of age. X-ray examination reveals a destructive lesion of the bone suggestive of a malignant growth. The peripheral blood generally shows a mild eosinophilia of four to 10 percent. Biopsy with histologic examination reveals large histiocytes with leukocytes, especially eosinophils scattered throughout the sections. The prognosis is favorable with or without surgical intervention or X-ray therapy.

1500 Medical Arts Building (2).

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CYTOLOGY OF THE CONJUNCTIVAL SAC

A QUANTITATIVE AND QUALITATIVE STUDY

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A quantitative and qualitative study of the cytology was made on the conjunctival material of normal subjects. The purpose of this study was to determine differences in the three commonly used techniques of obtaining such material.

MATERIAL

The group consisted of 29 males and 25 females. The average age was 54.8 years and the range was from 15 to 78 years. (No correlation of age or sex with cytology was attempted in this study.) None of the subjects had complaints referable to pathologic conditions of the conjunctiva and there was no apparent pathologic process upon gross examination of the adnexa or anterior segment.

The intention that the cytology of the "normal" conjunctiva be studied precluded the instillation of any material into the conjunctival sac[1] or any provocative manipulation[2] in order to facilitate the procurement of material. No anesthetic was employed in the taking of any sample in this study.

TECHNIQUE

Many different methods of obtaining material from the conjunctival sac have been advocated in the literature.[3-8] The three methods used in this investigation were chosen because of their simplicity.

1. *Dry swab.* A uniform, tightly wound cotton applicator was employed.

2. *Wet swab.* Just prior to use, the cotton tip of a dry swab was dipped in normal saline solution and then flicked several times to remove the excess moisture.

3. *Scraping.* Individual sharp-edged spatulas were manufactured from an impervious, hard-composition fiber material. Each spatula was identical in design and construction.

A standard procedure was followed in taking all samples. The subject was directed to look up; the lower lid was held in an everted position; and the instrument was deftly passed once across the lower sac from the temporal to the nasal side. The material was immediately spread over one-half the surface of a clean glass slide and then quickly dried in air.

STAINING AND MICROSCOPY

Giemsa is considered to be the best general differential cytologic stain.[9] The dilute Giemsa technique was employed in this study.

A routine procedure was followed in the examination of each slide in order to insure uniformity in observation and recording. One half of the prepared slide was examined under ×150 magnification. Identification was easily performed under this power.

TABLE 1

ANALYSIS OF RESULTS

Method	No. Cells	Poly.	Bands	Mono.	Lymph.	Plasma	Epith.	Misc.*	Total
1. Scrape	34	0	1	0	0	0	738	2	741
2. Wet	34	1,178	98	0	3	1	1,198	0	2,478
3. Dry	32	479	10	1	84	1	3,095	2	3,672
Totals	100	1,657	109	1	87	2	5,031	4	6,891
Average		16.57	1.09	0.01	0.87	0.02	50.31	0.04	68.91
Percent		24.5	1.6	0.1	1.3	0.3	71.5	0.6	100.0

* Cells recognized as such but which could not be identified.

If there was any uncertainty, further study was conducted under higher powers.

Results

The material from 100 normal eyes was studied. The cytologic classification of Thygeson[9] was adopted and modified to be all-inclusive. Table 1 analyzes the results.

Discussion

It was appreciated from the beginning that the cytologic findings in the clinical material depended on a number of general and local factors. It is generally acknowledged[10] that the conjunctival sac does not remain sterile long after birth. Many reports in the literature[11] reveal that there is a varying bacterial flora in the "normal" conjunctiva. Consequently, it may be assumed that the conjunctiva would manifest a varying cytologic picture, depending upon the type of organism and its virulence.

Age influences both the histology[12] and the flora[13] of the conjunctiva. Nutritional deficiencies and endocrine imbalances are reflected in the epithelium and epithelial studies have been employed to detect these conditions.[5] However, all such factors were ignored in the present study because it was felt that such variables would tend to cancel out in the final evaluation.

A quantitative analysis of the microscopic findings showed that the average number of cells per slide was 68.91. The number of cells per slide varied from 0 to 1,085. The numerical variability is in accord with similar observations in the literature which reported that scraping under anesthesia yielded from "7 to 587 cells from each eye."[3] (Note: Only epithelial cells were counted. Cell clumps were not included. Specimens with less than 35 cells from both eyes were discarded as unsatisfactory for study.) The instillation-aspiration technique yielded from 1 to 1,105 "white cells."[14] (Note: No differential studies of cytology were made.)

The findings summarized in Table 1 indicate that several different types of cells compose the cytologic picture shown by the normal conjunctiva. However, from an individual point of view, 79 percent showed epithelial cells only; 15 percent showed an occasional odd cell in addition to the epithelial cells; the remaining six percent presented a mixed cytology. It may be concluded that, in a great percentage of cases (94 percent), the qualitative cytology consists of a preponderance of epithelial cells and an occasional odd cell. No further studies were made on the mixed smear group (six percent).

Slides made by the dry-swab and wet-swab methods were much easier to study. The cells were more evenly distributed over the slide and appeared flatter and less distorted than in the preparations made by the scraping method. There was less granular, amorphous material. The numerical differences in the total cell count by the three techniques may be partly attributed to the very small amount of free fluid present in the normal conjunctival sac. This was impressively demonstrated by the minute amount of material obtained on the spatula.

Summary and Conclusions

A comparative study of the cytology in 100 specimens taken from "normal" conjunctivas by three methods is reported.

The dry and wet swab methods were found superior to the scraping method of obtaining conjunctival cellular material for microscopic study.

1073 Broadway (12).

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THROMBOSIS OF THE CENTRAL RETINAL ARTERY*

Report of a successfully treated case

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Thrombosis of the central retinal artery as a result of arteriosclerosis is relatively common in the older age group. However, it is relatively uncommon in individuals under the age of 40 years.

We are presenting this case because of its successful outcome, which is probably due, to a great extent, to the rapidity with which the patient sought medical attention.

Case report

History. This 37-year-old Negress was admitted to the Emergency Room at 9:00 p.m. on February 17, 1953. Her chief complaint on admission was sudden painless loss of vision in the right eye. As the patient stated, "It was as though a curtain had been drawn over the sight of the eye." This incident had occurred 20 minutes before, while the patient was at home. There was no history of trauma nor other symptoms at this time. The patient was seen by the eye residents on duty at 9:10 p.m.

Examination of the eyes. The pupil of the right eye was dilated, fixed, and did not react to light. Vision in the right eye was limited to temporal light projection. Vision in the left eye was apparently normal, the patient could read two-mm. print at 14 inches. The remainder of the external examination was essentially negative.

Funduscopic examination of the right eye revealed a fairly typical textbook picture of central retinal artery occlusion. There was generalized retinal edema, most marked between the disc and the macular area. The macula showed the typical "cherry red spot." There was narrowing of all the arterial vessels.

There were three areas of retraction in the blood column in the superior vessels and one area of retraction in the blood column in the superior nasal artery. No motion or pulse wave could be detected in the blood column in any arterial retinal vessel. Examination of the left fundus was negative.

After the diagnosis of central retinal artery thrombosis was made, the following

* From the Department of Ophthalmology, Medical College of Virginia.

procedures were carried out:

9:20 p.m.: Inhalation of amyl nitrate.

9:30 p.m.: Retrobulbar block with two cc. four-percent procaine.

9:45 p.m.: Blood drawn for laboratory examinations. Papaverine (1.0 gr. given intravenously).

10:00 p.m.: Fundus examination right eye. The retinal edema was less. The areas of clotting in the superior nasal and the superior temporal vessel seemed to be moving out toward periphery. The fragmentation of the blood column in the superior nasal artery had disappeared.

10:15 p.m.: A second retrobulbar block with two cc. four-percent procaine was given. Bleeding time one minute 40 seconds. Clotting time: 5-7-7 minutes. Prothrombin concentration reported as 60 per cent (normal value 50 to 100 percent).

10:25 p.m.: Heparin (100 mg. given intravenously). Dicumarol (200 mg. given orally).

10:40 p.m.: The clotting is now present in the superior temporal artery only. A pulse wave can be visualized at the bifurcation and traveling into the inferior vessels. Light projection present nasally, temporally, and inferiorly but none superiorly in the ischemic area representing that portion of the retina supplied by the occluded vessel. The retinal edema continues to lessen, most markedly superiorly. A second amyl nitrate inhalation was given. The patient was started on nicotinic acid (50 mg., every four hours). She was given Nembutal (1.5 gr.) as sedation and admitted to the ward.

Physical examination on admission revealed a well-developed and well-nourished, slightly obese Negress, lying quietly on the examining table, in no apparent distress.

Temperature: Not taken. Pulse, 88. Blood pressure, 140/82 mm. Hg. Eyes, as previously noted. Neck, negative. Thyroid not palpable. Chest, equal expansion. Lungs, clear to percussion and auscultation. Breasts, negative. Heart, rhythm regular, sounds normal, no murmurs heard, not enlarged to percussion. Abdomen, midline suprapubic scar, soft, relaxed, no masses, nor tenderness. Liver, spleen, and kidney not felt. Genitourinary, deferred. Extremities, negative. Neurologic, negative.

Past history. 1. Typhoid fever as a child.

2. Lues diagnosed in 1937, treated irregularly with Arsphenamine and later with Marpharsen. Complement fixation test negative in 1948. Quantitative serology positive 1:4 in 1948. Complement fixation negative in 1953.

3. Pleural effusion in November, 1941. A diagnosis of hilar tuberculosis with effusion was made. The patient spent three months in a sanatorium and was discharged as arrested tuberculosis in January, 1942.

4. Gravida 4 para 2. Delivered a stillborn, macerated fetus in 1937, then subsequently had two uneventful pregnancies. A therapeutic abortion and sterilization was done in 1942 because of the tuberculosis history.

Course. When seen on the morning of February 18, 1953, the pupil of the right eye was normal and reacted well to light. The patient was brought to the Eye Clinic for dilatation of the pupils and further study.

The visual acuity at this time was: O.D., 20/30−2; O.S., 20/15−2. Fundus examination of the right eye at this time revealed a small area of thrombosis in the second branch of the superior temporal artery with some edema in the adjacent areas.

Additional laboratory reports revealed a negative serology and an essentially negative urinalysis. Hemoglobin, 10.2 gm.; WBC, 9,350.

The patient was continued on sedation, nicotinic acid, and anticoagulants until February 24th, at which time the anticoagulants were discontinued because of hematuria. The patient's vision continued to improve. On February 27, 1953, the visual acuity was: O.D., 20/20+3; O.S., 20/15.

Fundus photographs were taken on February 25th. These showed an area of narrowing and thrombosis in the second branch

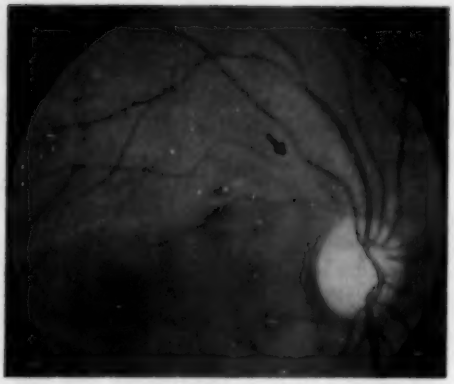

Fig. 1 (Guillette and Mayer). Fundus photograph, showing an area of narrowing and thrombosis in the second branch of the superior temporal artery and some surrounding edema.

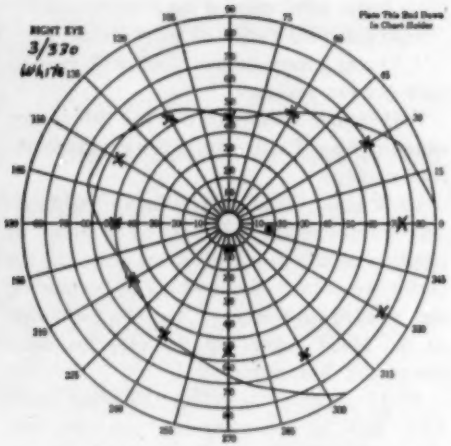

Fig. 2 (Guillette and Mayer). Visual field taken about three weeks after the attack.

of the superior temporal artery with some surrounding edema (fig. 1).

The patient was discharged on February 27, 1953, on nicotinic acid (50 mg., four times daily).

The patient was seen again in the Eye Clinic as an outpatient on March 9, 1953. The visual acuity in her right eye at this time was 20/15—1. A fundus examination revealed less edema but persistence of the area of narrowing and thrombosis in the second branch of the superior temporal artery. The visual fields at this time revealed full peripheral fields, O.U., and a small absolute scotoma in the right eye, below the fixation point (fig. 2). The patient was continued on nicotinic acid (50 mg., four times daily).

Examination on March 16, 1953, revealed no change, except that the scotoma was somewhat smaller.

Examination on March 30, 1953, revealed that the retinal edema had completely disappeared and the thrombosed branch of the superior temporal artery now seemed patent. However, there were a few pigmentary changes in the macular region. The patient was advised to stop all medications and to return in two weeks.

When last seen on April 13, 1953, the visual acuity in the right eye was 20/15−3 and the visual fields were completely normal. The pigmentary changes in the macula, previously noted, were still present.

Summary

A case of successfully treated thrombosis of the central retinal artery is presented along with an outline of the emergency treatment performed. The patient has been appraised of the situation and the possibility of recurrence. With this thought in mind, she has been given a letter stating the previous diagnosis and has been advised to seek immediate medical attention in the event of a recurrence.

1200 East Broad Street (19).

We are indebted to the Galeski Optical Company of Richmond, Virginia, who provided us with the fundus photographs.

ALPHA TOCOPHEROL TO TREAT DIABETIC RETINOPATHY*

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AND
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The therapy of diabetic retinopathy has included many diverse agents—some selected on an empirical basis and others chosen because of their known effects on the finer divisions of the peripheral vascular system. Preparations of rutin have been advocated for some time as effective in this complication of diabetes. However, studies indicate that these drugs have an equivocal effect on the progress of the disease, which is erratic and unpredictable at best. Most investigators have, therefore, concluded that the administration of rutin to patients with diabetic retinopathy did not materially affect the progress of the disease. All that can be said to date is that this approach to the therapy of the disease deals with prevention of further loss of visual acuity and with decreasing capillary fragility, rather than improving reduced visual acuity.

A number of authors are more concerned with the exudative retinal lesions than with alterations in capillary fragility as demonstrated elsewhere by various tests. Alpha tocopherol (vitamin E) has been administered to patients suffering from peripheral diseases or from diseases produced by fibrous tissue abnormalities. The results of this therapy have also been far from conclusive. However, we still considered that it was worth trying alpha tocopherol to treat diabetic retinopathy.

Cases were selected which exhibited the constant, although not pathognomonic, fundus picture of diabetic retinopathy—sharp, waxy exudates, punctate hemorrhages, and capillary microaneurysms. Patients who showed these findings as well as those of advanced hypertensive retinopathy (cotton-wool patches, flame-shaped and round hemorrhages) were excluded. This accounts for the small number of cases presented.

Twelve patients were selected from those under observation at the Diabetic Clinic and Eye Clinic of the University Hospital. In each case the diabetes was of long duration, the hyperglycemia was adequately controlled without marked changes, and no changes were detected in insulin requirements during prolonged administration of the alpha tocopherol.

Patients were all females, with ages ranging from the fifth to the seventh decade. Complete ophthalmic examination was done on each patient, including refraction, so that a base-line of maximum visual acuity was obtained.

Funduscopic examination was done after initial dilation with 10-percent neosynephrine, and sketches were made of each fundus. In this way an objective record of the pathologic retinal condition was kept for comparison after the tocopherol was administered.

Dosage of tocopherol was begun at 200 mg., three times a day for two months, and then was reduced to 100 mg., three times a day.

Funduscopic examination and check of visual acuity were then done once a month. The general status of each patient was also checked monthly in the Diabetic Clinic. After several months' administration of the drug, there were no complaints due to side effects. A few patients stated that they felt some increase in general well-being. No complications arose during the time of treatment.

RESULTS

No increase in base-line visual acuity was recorded. There was no demonstrable improvement in the ocular status of the patients after 15 months of treatment. No change in fundus lesions could be demonstrated, as

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evidenced by refraction, after the drug was discontinued.

Conclusions

The empirical use of alpha tocopherol acetate, in dosage from 300 mg. to 600 mg. every day for protracted periods, had no demonstrable effect on the progression of diabetic retinopathy, as observed in 12 patients.

2020 North Charles Street (18).

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SYSTEMIC COMPLICATIONS OF RETINAL DETACHMENT SURGERY*

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During the past 10 years, the deleterious effects of prolonged bedrest, particularly in older people, have been given wide discussion in medical literature.[1, 2] The occurrence of three serious complications following retinal detachment surgery stimulated this study to determine the relationship of prolonged bedrest to the incidence of these complications.

The five-year period from January, 1947, to January, 1952, was selected for study. By 1947 numerous medical papers had been published stressing the dangers of prolonged bedrest so that physicians were more alert to the complications that might arise.[3, 4] The problem of anesthesia was considered unimportant in this series since only two operations were performed under general anesthesia, both in young children and neither developed any complications.

The subjects were all general-service and private patients admitted to the Brooklyn Eye and Ear Hospital during the period 1947-1952 with admission diagnoses of detachment of the retina with or without other complicating ocular disorders. The reasons for failure to have definitive retinal detachment surgery will be brought out and the relationship of postoperative complications to prolonged bedrest will be explored. Since 89 of the 263 patients were seen in the last year of this study and could not be followed for an adequate period of time a compilation of the results of surgery would serve no useful purpose and is omitted.

The 263 patients in the series included 145 males and 118 females. The average age was 52 years, with a range of eight to 78 years; 75 percent of the patients were over 45 years of age. The average length of time in bed postoperatively was 20 days; 90 percent of the patients operated upon remained in bed from 14 to 25 days. We have then a situation in which patients in the older age groups were subjected to periods of bedrest considered to be detrimental to their health.

In 13 patients a history of trauma was obtained; 28 had myopia characterized as "high" on the admission note. One case followed an attack of acute primary narrow-angle glaucoma; another followed an attack of uveitis with secondary glaucoma. In the series, 24 eyes were aphakic. The majority of cases showed no apparent cause for the retinal detachment.

There were 53 patients who did not have definitive surgery for retinal detachment. After admission for study, 11 signed out against advice. Of 22 patients who were not offered surgery because they were regarded

* From the Brooklyn Eye and Ear Hospital, Brooklyn, New York.

as poor risks from the standpoint of general medical history, all but two had either hypertensive cardiovascular disease, coronary artery disease, chronic pulmonary infection, or oral sepsis; these two were refused surgery because the attending staff considered them psychologically unfit. In 20 cases, retinal detachment surgery was refused because of accompanying ocular pathologic conditions. Nine eyes were enucleated because of a preoperative diagnosis of malignant melanoma; seven were proved by pathologic study, one was a retinal cyst, the other an organized hemorrhage.

The postoperative complications therefore occurred in a group of 210 patients subjected to 274 operations. 45 patients were operated on twice, five had three operations, and three had four operations during the period studied. The incidence of diabetes in these patients was three percent. There were 11 cases with ocular complications. Since these were not related to general medical conditions or to rest in bed, they will merely be mentioned. There were five cases of vitreous hemorrhage, one of macular degeneration from diathermy puncture, one of bilateral herpetic keratitis, one of panophthalmitis with enucleation, and three of muscle imbalance with diplopia.

Systemic complications

The nonocular complications numbered 21. There was one death. Fourteen complications occurred during the first week, seven after at least two weeks in bed. They were divided into groups:

Group 1. Vascular

In this group there were five cases.

Of the four cases of thrombophlebitis of the leg veins, one had a pulmonary infarction; two occurred in the first week, one after two weeks, and one after 23 days in bed. The patients ranged in age from 48 to 69 years. Only one received anticoagulant therapy. All recovered and in each case the retina was noted to be in its normal anatomic position by the attending surgeon at the time of discharge.

The fifth case in this group was one of hemiplegia occurring on the fourth postoperative day in a 63-year-old man. There was no improvement in the hemiplegia after three weeks and the retinal detachment was not improved.

Group 2. Cardiac

Two cases of congestive heart failure occurred 14 and 22 days, postoperatively; one patient died. He was a 70-year-old man whose heart failure began after 22 days in bed; death came four days later. The other case was that of a 60-year-old woman who recovered and whose retina was noted to be attached at the time of discharge.

There were two cases diagnosed as angina pectoris by the consulting internist. These attacks occurred on the seventh and 16th postoperative days in a 56-year-old man and in a 59-year-old man, respectively. Both recovered but neither operation was successful.

Group 3. Gastro-intestinal

One case of postoperative ileus occurred on the second postoperative day in a 38-year-old man who recovered on conservative treatment and the retina was attached on discharge. A 74-year-old man had a severe gastric hemorrhage on the fifth postoperative day and survived after transfusion therapy. The ocular result was a failure.

A 58-year-old woman had a severe attack of biliary colic on her 25th postoperative day in bed. She was a high myope and the ocular result was a failure. A case of severe diarrhea of undetermined etiology in a 67-year-old man lasted from the sixth to the 20th postoperative day during his stay in bed. The patient's retina was attached at the time of discharge.

The final case in this group was that of a 41-year-old woman who developed a spontaneous perforation of a diverticulum of the large bowel on the second postoperative day.

She was transferred to another hospital. The perforation was repaired and after five months her retina remained completely attached.

Group 4. Respiratory

There were four cases of postoperative bronchopneumonia, all in women. Three of these occurred on the second postoperative day in patients who were aged 38, 58, and 59 years, respectively. The other patient was 72 years of age. She became ill on the 22nd postoperative day in bed. Her operative result was a failure. The retina was attached on discharge in the other three patients.

Group 5. Urinary

A 60-year-old diabetic man developed urinary retention two days postoperatively. After catheterization, a urinary tract infection became evident and his temperature rose to 103°F. Although he was permitted to stand to urinate on his third postoperative day and thereafter, his retina was completely attached at the time of discharge.

Group 6. Miscellaneous

An attack of acute arthritis due to gout occurred on the fifth postoperative day in a 55-year-old man. Specific treatment with colchicine was successful. The retina was attached at the time of discharge.

A 60-year-old woman started to hiccup upon returning from the operating room and continued to hiccup and vomit for six days. All types of treatment short of phrenic surgery were tried. The attack stopped spontaneously. At discharge the retina was attached.

Discussion

In the cardiovascular group, of nine complications five occurred after 14 days in bed. The 12 complications in the remaining groups occurred before a week of bedrest had elapsed, with two exceptions. An incidence of 21 complications in 274 operations corresponds to eight percent. The mortality rate (one death) was less than one-half percent.

As a comparative study, a series of lens extractions for senile cataract from January to November, 1952, was examined. In 728 operations, there was one nonocular complication. Shipman,[5] in a consecutive series of over 500 cases of retinal detachment surgery, reported one case of pneumonia, two cases of pulmonary thrombosis, and one fatal case of femoral thrombosis. This is an excellent record.

Statistically the results of the present study fail to show any correlation between rest in bed and the occurrence of systemic postoperative complications. Even in the cardiovascular group only a bare majority of complications occurred after 14 days in bed. The charts were then reviewed to determine whether any case that was noted to be detached after 14 days in bed had become attached on discharge without a second operation. In no instance had this happened. We feel that this fact must be taken into consideration in the management of these patients.

Kronfeld[6] has pointed out that, during the first week postoperatively, complete eye rest in a quiet room is essential. Nursing care should emphasize protection of the skin and supervise movements of the arms and legs to help prevent circulatory complications. These exercises may be started on the first postoperative day. When the flattening out of the retina is considered to be stable the patient is gradually allowed to be up and around.

Summary

During the period from 1947-1951, inclusive, 263 patients were admitted to the Brooklyn Eye and Ear Hospital with the diagnosis of retinal detachment. Of these, 53 did not have definitive retinal detachment surgery. The remaining 210 were subjected to 274 operations. There were 21 systemic complications other than ocular, an incidence of eight percent. There was one death. Fourteen of these complications occurred during

the first week in bed, and seven after at least two weeks in bed.

Conclusions

This series of patients demonstrated no correlation between rest in bed and the occurrence of systemic complications. In the cardiovascular group of complications, five out of nine complications, including the only death in the series, occurred after 14 days in bed. Kronfeld's suggested postoperative routine appears to be eminently satisfactory as a guide to the surgeon in deciding between too early movement and the possibilities of systemic complications.

5607 H.M.C. Street (21).

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Ophthalmic Miniature

But a most extra-ordinary circumstance, and what would be scarcely credible upon any single evidence, is, that the scars of wounds which had been for many years healed were forced open again by this virulent distemper. Of this there was a remarkable instance in one of the invalids on board the *Centurion*, who had been wounded about fifty years before at the battle of the Boyne, for though he was cured soon after, and had continued well for a great number of years past, yet on his being attacked by the scurvy, his wounds, in the progress of his disease, broke out afresh, and appeared as if they had never been healed; nay, what is still more astonishing, the callus of a broken bone, which had been completely formed for a long time, was found to be hereby dissolved, and the fracture seemed as if it had never been consolidated.

Richard Walter, Chaplain,
Lord Anson's Voyage Around the World, 1748.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 2, 1953

DR. ABRAHAM L. KORNZWEIG, *President*

TOTAL AMAUROSIS FOLLOWING PARTURITION

DR. ERNEST C. PRESTO said that permanent total blindness is an exceedingly rare complication following parturition. This 22-year-old Negress was admitted to the Queens General Hospital on July 21, 1952, in early labor at term.

Obstetrical history revealed one episode of vaginal-tract bleeding in the first trimester which subsided spontaneously. During the last two weeks before admission, she had complained of mild swelling of her ankles; however, her total weight gain was less than 30 pounds.

The medical history was essentially normal except for a "gonorrheal infection" at the age of 17 years. This was adequately treated with three intramuscular injections of penicillin. Physical findings of importance at the time of admission were: Blood pressure, 140/80 mm. Hg; one-plus pitting ankle edema. Laboratory studies were within normal limits.

She was considered to be a primipara at term, in mild pre-eclampsia. The position of the fetus (left occipit transverse) was determined clinically and confirmed by X-ray pelvimetry 12 hours after admission. After 33 hours of labor, during which time the amniotic sac was artificially ruptured and an unsuccessful attempt was made at manual rotation with Kiellan forceps, it was considered that a cesarean section should be done.

In the operating room, spinal anesthesia was attempted but abandoned after a traumatic bloody tap. Induction anesthesia with nitrous oxide, oxygen, and cyclopropane was begun. The patient was carried throughout the surgical procedure with ether-oxygen and cyclopropane for brief periods.

A Norton type of paravesical, extraperitonial cesarean section was performed which progressed successfully. However, a seven lb., eight oz. nonmascerated baby which did not cry or breathe was delivered. Attempts at resuscitation were unsuccessful.

The anesthesia record revealed a total operation time of approximately one and one-half hours. The blood pressure was noted to rise to 200/40 mm. Hg after 30 and 60 minutes of anesthesia. At the conclusion of the operative procedure, the pressure was recorded at 120/50 mm. Hg. Estimated blood loss was 500 cc.

Two hours after her return to the ward, she became weak, clammy, and perspired profusely. Blood pressure at this time was 90/40 mm. Hg. Shock therapy was immediately instituted including nasal oxygen, 500-cc. whole blood, and the use of Norepinephrine (a total dose of 0.4 cc. being used.)

Consultation with the medical service advised the use of intravenous adrenal cortical extracts and the use of vasopressors only for a blood pressure below 90 mm. Hg, systolic.

Shortly after treatment was begun, the blood pressure rose to 180/80 mm. Hg and vasopressors were discontinued. Six hours after surgery, her blood pressure stabilized at 140/70 mm. Hg and she was considered safely out of shock. Shortly before falling asleep, she complained of some diminution in vision.

Sixteen hours after surgery, an eye examination revealed the following:

External. Adnexa, normal; bilateral moderately dilated pupils which did not respond to light.

Vision. No light perception, O.U.

Fundus. O.D., a marked generalized diffuse edema of the retina, almost milky white. Marked arteriolar constriction, the vessels fading into the periphery; A/V ratio was 1:3 or more. Optic disc was well outlined and pale. A flame-shaped hemorrhage was noted along the superior temporal artery branch one disc diameter away. Fovea could not be detailed.

O.S. presented a similar picture. However, the optic disc was blurred. No measurable papilledema. No hemorrhages were seen.

The medical staff instituted therapy with intravenous and oral papaverine every two hours, and supplemented this with priscoline in doses of 50 mg. every four hours. A stellate ganglion block was administered on the right. No significant change was noted. Treatment was carried out for a period of two days without any return of vision. Three days after surgery, the picture was much the same. However, the fovea were now replaced by gray spots.

Five days later, fragmentation of the arterioles was noted with small multiple hemorrhages over the macular area. Her condition remained the same until her discharge.

Discussion. Dr. Isadore Givner said that this case was referred for an opinion as to the possible relationship to the anesthesia. The bilaterality and venous involvement are not seen as part of the picture in 17 cases that I know of which were due to the combination of shock and inadvertent pressure on the eye.

The age of the patient, together with the negative Wassermann, suggest a toxic factor rather than a vascular degeneration predisposing to the occlusion. The mild toxemia, the necessity for and the administration of Norepinephrine, the shock and the pregnancy itself, which causes increased sludge, are all factors that probably contributed to the occlusion.

Charles L. Schneider of Wayne University has described "fibrin embolism" with disseminated intravascular coagulation occurring in toxemias of pregnancy particularly in abruptio placenta. The process is a selective deposition of fibrin intravascularly occurring late in pregnancy. The chemical mediator is thromboplastin, the initiator of the activation of prothrombin, causing arterial occlusion.

In the case presented today, Dr. Schneider said, that, on the basis of the history, it is quite possible that it is a fibrin embolism. He does not know of any direct studies of lesions in the eye after injection of tissue thromboplastin. He has studied sections of eyes of a few animals injected with decidual or placenta thromboplastin extracts and the only ocular lesion was a subchoroidal hemorrhage in one mouse. He reports that, if appropriate conditions were chosen, it may be that lesions in the eye could be produced more regularly.

Ocular compression combined with intravenous thromboplastin injections up to two cc. were done by Sanacore and did not produce a thrombosis in a rabbit's fundi.

A case seen by Seidel and reported in 1939 is pertinent. This patient, a woman, aged 45 years, presented herself at the clinic very soon after a sudden disturbance of vision in the right eye. Her past history showed that she had suffered from migraine and cold hands and feet.

The patient, when seen, showed venous congestion of the retinal veins and narrowing of the retinal arteries. Twenty minutes later vision was worse and the veins were fuller; the papilla was congested and a small hemorrhage appeared near the papilla. A little later edema appeared peripherally and in the region of the macula. Finger vision was now noted. Two months later secondary glaucoma occurred and enucleation was done. The sections show thrombosis of the central retinal vein with thickening of the intima of arterioles on the disc and in the retina.

Optic atrophy complicating tuberculous meningitis

Dr. Jules Landowski said that, according to Walsh, atrophy of the optic nerve is rarely, if ever, seen in tuberculous meningitis, since there is insufficient time for atrophy to develop before death occurs. This situation has changed since the advent of the latest antituberculosis drugs, namely streptomycin and the isonicotinic acid hydrazides, and this permits presentation of a case of bilateral optic atrophy complicating a tuberculous meningitis successfully treated by the hydrazide.

A Negro boy, aged four and one-half years, was admitted to the Beth David Hospital on May 22, 1952. He had been suffering from general malaise, nausea, vomiting, constipation, somnolence, stiffness of the neck, photophobia, and elevated temperature between 100°F. and 102°F. for the week prior to admission.

The previous history revealed only frequent upper respiratory infections during winter, German measles at the age of nine months, and measles one month before admission. There was a history of contact with active tuberculosis in a grandmother living in the same apartment, who died one year before the onset of the child's present illness.

The first impression on admission was that of a postmeasles encephalitis but the possibility of tuberculous meningitis was considered. The first spinal puncture performed on the day of admission showed cloudy fluid, slight increase in cells, but negative smear and culture.

Five days later the spinal puncture was repeated and now numerous acid-fast bacilli were found in the smear. X-ray plates of the lungs were negative except for a left hilar calcification. Immediately upon admission, administration of penicillin (300,000 units three times daily) was started, followed two days later by streptomycin (250 mg., every six hours) intramuscularly, and teramycin (250 mg., three times daily) per os.

After discovery of acid-fast bacilli on the sixth day, isonicotinic acid hydrazide therapy was instituted and the patient was given 300 mg. daily for seven weeks, followed by 200 mg. daily. After six weeks of this treatment, there was a marked improvement in the general condition. His mental status cleared up rapidly, the rigidity of the neck disappeared, the temperature returned to normal.

It was at that time that poor vision was noticed for the first time, and that the ophthalmologic consultation was requested. The eye examination disclosed the following:

There was some photophobia, the light reflexes were absent. Both optic discs appeared pale, fundi otherwise normal. Vision was very poor.

Subsequent examinations confirmed the diagnosis of bilateral optic atrophy, otherwise the fundi remained normal throughout the course of the disease. At the last examination on January 19, 1953, the child appeared to be in perfect health except for his eyes. Both fundi showed marked pallor of the disc and nothing else. The vision was reduced to light perception and apparently good light projection.

Dr. Landowski concluded that tuberculous meningitis does produce atrophy of the optic nerve.

Reiter's syndrome

Dr. Frederick H. Theodore said that the symptom complex known as Reiter's disease is assuming increasing importance not only because it is being encountered more frequently but also because of the severe disabilities that may follow. At the present time, the cause of the condition is unknown and a great deal of confusion still exists as to exactly what constitutes the disease. Even the name is undeserved.

Generally, Reiter's syndrome is initiated by a nonbacterial urethritis, followed by transient mild conjunctivitis (less often ker-

atitis, iritis, and secondary glaucoma occur), and later by severe polyarthritis.

In 1916, Reiter described a case following acute dysenteric symptoms. Actually the association of dysentery with conjunctivitis and arthritis had been noted 50 years previous to that, while the classical symptom-complex of urethritis, conjunctivitis, and arthritis was described in considerable detail as long ago as 1818 by Sir Benjamin Brodie.

At present, cases in which only part of the triad occurs, in association with skin or mouth lesions, are also included by some authors under the heading of Reiter's disease. Thus, many reported cases appear very similar to erythema multiforme and Behçet's syndrome. In fact, all of these syndromes may well be variants of the same disease.

Many micro-organisms have been incriminated as the cause of the syndrome, but none has withstood the test of time. Currently "L" organisms of the pleuropneumonia group and the virus of inclusion conjunctivitis (a cause of nonspecific urethritis) are mentioned most frequently. However, some authors, including myself, have found all studies, including bacterial, viral, and animal inoculation, to be completely negative.

The two patients presented showed the full classical picture of Reiter's disease. In each instance the patient was a young man with a history of recurrent attacks of the disease. One was suffering from the sequelae of severe iritis and secondary glaucoma.

In each case the present episode was ushered in by transitory nonbacterial urethritis, followed by mucopurulent conjunctivitis (responding to local instillations of cortisone), and then by severe incapacitating polyarthritis, involving the larger joints, such as the knee and the wrist.

Etiologic studies of the urethra, the conjunctiva, and the involved joints were all negative. These studies included viral and bacterial cultures, epithelial conjunctival scrapings, and animal inoculations.

The systemic use of penicillin, aureomycin, and terramycin for long periods of time proved ineffective in each case. Both patients remained febrile and bedridden due to the polyarthritis. In one, however, hydrocortisone was injected into the knee joint with rapid subsidence of the involvement in that joint. Dramatic improvement then occurred in both cases within a day after the systemic administration of cortisone was begun. Symptoms returned when it was discontinued.

These studies support the recent experiences of others that cortisone and ACTH are of value in Reiter's disease. The excellent response to these agents, coupled with the ineffectiveness of the antibiotics and sulfonamides, is against a viral or bacterial etiology, and might suggest an allergic basis for the syndrome.

Papillomatosis of conjunctiva

Dr. Benjamin Esterman said that he had seen a case of a seven-year-old boy who, since the age of one, had had six recurrences of papilloma of the conjunctiva, apparently associated with verruca vulgaris on other parts of the body. While all the papillomas have been on one eye, they have occurred in different parts of the conjunctival sac; all this despite careful excision, beta radiation, and wart vaccine.

The child has had 19 doses of beta radiation for a total of 32,400 r divided among eight different fields of the conjunctiva, total dose for each field varying from 1,800 to 7,800 r. Intracutaneous injections of 0.1 cc. Biberstein wart vaccine have been administered 45 times in the past two years.

While recurrent papilloma of the conjunctiva is somewhat rare according to the literature, cases have been reported which have become malignant after repeated recurrences, invading the orbit as epitheliomatous growths and spreading even after orbital exenteration.

Discussion. Dr. Hans Biberstein said that the history of the present case is of

special interest in that the mother of the boy had condylomata acuminata during the later part of her pregnancy; they spontaneously disappeared after delivery. Considering the close relationship of warts and condylomata acuminata and the fact that the boy has been suffering from warts and papillomas almost since his birth, an intrapartum infection is suggested. His father had a wart on one finger when I saw the patient for the first time.

A second interesting point is the resistance of the conjunctival lesions to the treatment with wart vaccine in contrast to the response of all his warts in other locations. Such individual rest warts were occasionally observed in other patients who lost all warts except one after immunization therapy. This phenomenon is not yet explained.

The appearance of new growths in different parts of the conjunctiva after intervals following local treatments most probably is due to inoculations of the virus from a papilloma previously present, since there is a long incubation period (six weeks to three years).

The presence of mitoses may characterize the growths of the conjunctiva as tending more toward the condyloma acuminata type and not necessarily toward a malignancy.

Dr. Biberstein then discussed the use of wart vaccine, namely whether its effect could be explained on a psychotherapeutic basis or whether it has a specific immunizing effect. The following data support the contention that it has an immunizing effect:

1. A group of patients treated with wart vaccine resulted in 72.5-percent cures in verrucae vulgares, 90.9 percent in verrucae planae, and 90.4 percent in condylomata acuminata. Another group of patients, who did not know of the difference in the antigen, treated with an extract of normal human skin, resulted in 30 percent, 28.6 percent, and 20 percent for the corresponding conditions.

2. Patients, resistant after 20 and more injections of normal skin extract, reacted to the wart vaccine.

3. Patients resistant to psychotherapy reacted to wart vaccine.

4. Patients resistant to one wart vaccine reacted to a different one, especially to one made from the warts of a resistant case.

5. Cattle, horses, and dogs suffering from warts readily reacted to wart-vaccine injections.

6. Definite differences between the effect of papilloma antigen and nonspecific means could be demonstrated in Shope papilloma in rabbits.

Uncommon complications of scleritis

Dr. Isadore Givner said that, for purposes of description, scleritis can be considered as being either anterior or posterior. The deeper type of anterior scleritis is rarer than the superficial but much more serious. Four cases of scleritis were presented.

Case 1. A man, aged 49 years, had recurrent attacks of sclerokeratitis which resulted in obstruction of all aqueous veins and produced a glaucoma that could not be controlled at all with miotics. A trephining operation stabilized the tension. The increased pressure in the diseased sclera resulted in such a thinning of the sclera that the ciliary body zone could easily be visualized externally by direct observation.

Case 2. A man, aged 77 years, had repeated attacks of scleritis associated with retinal detachment which became spontaneously reattached when the scleritis subsided. Four such attacks occurred and the reattachment took place in from 16 days to two months with medical measures only.

Case 3. A woman, aged 45 years, had two attacks of scleritis, each of which was accompanied by choroidal detachments with reattachment of the choroid after subsidence of the scleritis.

Case 4. Posterior scleritis. S. S., aged 32 years, had scleritis in both eyes for the past 11 years. Four years after its presence, bi-

lateral papilledema, measuring three diopters appeared in each eye. Five years after onset of the scleritis, exploratory craniotomy was done for headaches and beginning loss of vision due to papilledema. Nothing was found. Eight years after onset, retinal cysts developed in each macula.

At the present time, vision in both eyes is 1/200 with a central scotoma in each eye. In addition to elevated nerveheads, there is choroidal detachment in the lower portion of the disc and retinal detachment, well walled off, superotemporally. All general examinations and laboratory studies were normal except for increased sedimentation rate. The opinion of all physicians who have seen the patient is that the ocular findings are the result of a posterior scleritis, cause undetermined.

Plastic repair of deformed lower lid

Dr. Ernest L. Metzger presented the case of a 68-year-old woman, with blood pressure of 200 mm. Hg and weight about 200 pounds. Two days before the initial examination, the patient had a fainting spell and fell down the stairs for about 12 feet, landing on her face. A few hours later a hemophthalmos developed. It was impossible to open the right eye and there was a prolapse of the conjunctiva. X-ray studies of the skull did not reveal any bone fracture. After a few days the eye could be examined. A hyphema filled half of the anterior chamber, the iris was in normal position, but the lens was subluxated subconjunctivally. A perforating wound 3.5 mm. from the limbus was well closed. The field was almost normal and, with a lens of plus 12, fingers could be counted.

The explanation of the mechanism of the accident is simple: an enormous force must have hit the eyeball from below and dislodged the lens so violently that the sclera burst just in front of the insertion of the upper eye muscle. The lens was delivered intracapsularly underneath the conjunctiva which also showed a perforation.

After one month this condition of the eye changed. Repeated hemorrhages occurred, the vision decreased rapidly, and the eye became so inflamed and painful that, 40 days after the accident, it had to be enucleated. The operation was done under local anesthesia.

A prosthesis was tried after the normal interval but could not be held in the socket. A tendency of the lower lid to turn out was obviously due to the primary lesion of the lid ligaments and the orbicularis muscle. As soon as the facial muscles contracted, the upper lid pushed the prosthesis back and downward, the lower lid jumped outward, and the prosthesis was violently ejected.

After the literature was reviewed, the procedure of Szymanowski seemed the most promising in this case. He separates the lid into two layers and excises the skin in a triangle at the temporal side. The tarsus is shortened by excising a triangle in the middle of the lid.

Measurements showed that, in the present case, this procedure would not provide sufficient space in the lower fornix. Therefore, the following procedure was used:

Instead of joining the tarsus pieces where the triangle had been taken out, the triangle was fitted in upside down and, thus, the upper margin of the lid was considerably tighter while the lid was satisfactorily widened in the fornix region. Before fitting in the tarsus triangle, as much as possible of the meibomian gland was destroyed by splitting the tarsus to two thirds intramarginally and curetting.

The operation was performed five years ago. The outlines of the triangle are still visible. The patient wears a plastic prosthesis without the least discomfort.

Bernard Kronenberg,
Recording Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

411th Meeting

February 18, 1953

DR. ANDREW L. MACMILLAN, JR., *presiding*

CYCLO-ELECTROLYSIS AND CYCLODIATHERMY IN GLAUCOMA

DR. RAMON CASTROVIEJO of New York, speaker of the evening, discussed his experience in about 500 cyclodiathermy operations for the treatment of glaucoma performed over the past five years. He had become discouraged with the results of routine glaucoma operations and was inspired to try cyclodiathermy after seeing it used successfully by Dr. Franceschetti of Switzerland. When surgery is indicated, Dr. Castroviejo now uses cyclodiathermy in all cases of glaucoma regardless of type.

A 1.5-mm. electrode, insulated with rubber, is inserted through the conjunctiva and into the sclera five mm. to six mm. from the limbus. The electrocoagulation is performed with a current of approximately 45 milliamperes maintained for 10 seconds. As many as 16 points (four in each quadrant) may be used at one operation, depending upon the severity of the case. When 16 electrocoagulations have been performed, no more than four electrocoagulations at a time should be used at subsequent procedures because of the possibility of causing phthisis bulbi.

Eight electrocoagulations are used initially in patients whose tension can be brought into a normal range with medication and in cases in which surgery is indicated because the patient is unreliable, fields continue to deteriorate, and so forth. When the tension cannot be brought into normal range by medication, 16 electrocoagulations are used initially. If the tension tends to rise again, six weeks later more electrocoagulations can be done.

Cyclodiathermy has been as effective in Negroes as in whites.

Mild iritis may result but is usually controlled by the local use of cortisone. Phthisis bulbi has resulted when too much cyclodiathermy was used.

Intraocular infection occurred several times early in Dr. Castroviejo's series, but he believes the infections were due to a source of contamination that was eradicated.

Patients with abnormal diabetic retinopathy and those with absolute glaucoma do not respond well to the operation.

The operation causes an atrophy of ciliary processes and it is felt that this is the mechanism which reduces the tension.

Discussion. QUESTION: Have you treated buphthalmos with cyclodiathermy?

DR. CASTROVIEJO: I have treated some cases successfully. Since the ciliary body is often located more posteriorly, the diathermy points should be placed farther back.

DR. F. H. VERHOEFF: Have you treated hemorrhagic glaucoma?

DR. CASTROVIEJO: I have treated some cases with poor results others with good results. I treated one diabetic with rubeosis where the tension was normalized and the rubeosis disappeared. Two cases of glaucoma following occlusion of the central retinal vein were treated, one successfully, one without success.

DR. VERHOEFF: When a patient has both glaucoma and cataract, do you advise doing the diathermy first and then the cataract operation?

DR. CASTROVIEJO: Yes. I prefer first to neutralize the tension and then to operate on the cataract.

DR. VERHOEFF: We know that there is a lack of aqueous outflow in glaucoma. If this operation decreases aqueous formation, a more or less stagnant situation must be created. Have you seen any harmful results from this in your five years' experience?

DR. CASTROVIEJO: No.

DR. PAUL A. CHANDLER: What period of time must a patient's tension remain normal

before you feel he will be all right—three months?

DR. CASTROVIEJO: Some patients are all right in three months and show a rise in tension in six months, requiring further operation. I seldom repeat the operation before the third month. If patients are normal a year after operation, I feel they are good forever.

QUESTION: Have you had any cases of sympathetic ophthalmia?

DR. CASTROVIEJO: No.

QUESTION: What kind of anesthesia do you use?

DR. CASTROVIEJO: Retrobulbar anesthesia alone.

QUESTION: What medication do you use immediately after operation?

DR. CASTROVIEJO: I continue with miotics, pilocarpine, or eserine. Use sedatives as necessary.

QUESTION: Have you found any accommodative changes after the operation?

DR. CASTROVIEJO: No.

Dr. Henry A. Mosher,
Recorder.

YALE CLINICAL CONFERENCE

March 6, 1953

DR. R. M. FASANELLA, *presiding*

LACRIMAL SURGERY

DR. BYRON SMITH, New York, discussed various aspects of surgery of the lacrimal apparatus and illustrated his talk with slides and a moving picture.

A case of orbital cellulitis was demonstrated, in which the lower orbital swelling was noted to be more temporal than the usual location for peridacryocystitis. In the case of a swelling above the medial canthal ligament, the differential diagnosis between sinusitis, orbital cellulitis, and a peridacryocystitis must be considered. The occurrence of streptothrix concretions in the canaliculi and the nasolacrimal duct was discussed.

Epiphora due to deviations of the punctum, congenital or acquired, was described. In the acquired type with ectropion, a graft is usually necessary. In a case of congenital fistula inferonasal to the medial canthus, surgical closure was successful only after patency of the nasolacrimal duct was established.

A moving picture was shown of dacryocystorhinostomy in a case of fracture of the facial bones with downward displacement of the medial canthus. One cause of failure in dacryocystorhinostomy is too small a bony opening. It was advised that the bony opening be at least eight to 10 mm. Anesthesia for the operation should include intratracheal intubation and a postnasal pack to prevent aspiration of blood. Caution in the use of postoperative pressure dressings should be observed. The loss of three eyes because of pressure on the cornea was observed by the speaker.

The repair of lid lacerations was discussed. Dr. Smith prefers the figure-8 stitch, splinting both halves against the opposite lid. The classical halving operation is unsuitable where multiple lacerations would require sacrifice of too much tissue. Various methods of repair of canaliculus laceration were mentioned. The location of the medial cut end of the canaliculus can sometimes be aided by injection of water, air, or sterile milk into the opposite punctum.

The cause of epiphora after facial paralysis is not well understood. Lateral tarsorrhaphy to tighten the lower lid can be done. The entire canaliculus can be unroofed. Also the internal canthus may be elevated by a Z-plasty. A procedure was described for suturing the punctum nearer the lacrimal lake by excising a small piece of tarsal conjunctiva adjacent to the inner aspect of the canaliculus.

Care in probing the duct in infant dacryostenosis was advised. Some method, such as insertion of a second probe in the nostril to

contact the lacrimal probe, was advised to make sure the lacrimal probe actually gets into the nasal cavity and does not merely push a fold of nasal mucous membrane ahead of it.

In the procedure of dacryocystorhinostomy, several points were noted. One should avoid injury to the portion of the canthal ligament that goes behind the sac to attach to the posterior lacrimal crest in order to avoid temporal displacement of the medial canthus. No attempt to resuture accurately the medial canthal ligament is necessary. The bony opening should be centered on the anterior lacrimal crest, not too high nor too far posteriorly. The Castroviejo needle was preferred for suturing the posterior flap. When tying the sutures of the anterior flap, the retractors should be removed to allow approximation without the sutures cutting through.

Discussion. Dr. Van Heuven said there was no indication for dacryocystectomy except in tuberculosis or tumor. He always uses local anesthesia. Bleeding is controlled to a large extent by pressure of the speculum which is inserted immediately after the incision. He uses Dermolon wire as a temporary probe which is moved daily postoperatively. The necessity of suturing the mucous membrane flaps was questioned.

Dr. Kaplan has used polyethylene tubes in six or seven cases. Two tubes came out very soon; the others gave good results. In two cases, the tubes are still in place after a year.

Dr. Little asked Dr. Smith what anesthesia he uses for office probing of the nasolacrimal duct.

Dr. Smith stated that he doesn't probe in the office, as experience has shown that it is generally too painful and the patient may not return. Nothing short of complete procaine anesthesia is satisfactory.

Dr. Fasanella inquired about operations on the lacrimal apparatus in infants. Dr. Smith said that one can do a dacryocystorhinostomy if no response to probing is obtained, even at the age of two years.

William I. Glass,
Recording Secretary.

LATIN OPHTHALMOLOGICAL SOCIETY

June 10-13, 1953

The first congress of the newly organized Latin Ophthalmological Society was held at the Palazzo Barberini, Rome, June 10 to 13, 1953. Among the ophthalmologists from 20 countries who took part in the scientific and social activities were Sir Stewart Duke-Elder (London), president of the International Council of Ophthalmology, and Prof. Moacyr Alvaro (São Paulo, Brazil), president of the Pan-American Association of Ophthalmology, who came to testify their friendship for the new society.

The ceremony of inauguration, which took place on June 10th at the capitol, was under the chairmanship of the Mayor of Rome and was attended by His Eminence, Cardinal Micara, Vicar of Rome. The inauguration address was presented by Dr. P. Bailliart of Paris.

On the same day, Dr. Saint Martin and Dr. Jean Sédan of France presented their report on postoperative astigmatism, as well as illustrations made by Professor Amsler of Zurich. The paper was ably discussed by Marquez (Mexico), Coppez (Brussels), Vila-Coro (Barcelona), Campos (Trieste), Charamis (Athens), Castroviejo (New York), Paufique, Sourdille, and Bregéat (France), Lopez de Andrade and Moutinho (Lisbon), Cattaneo (Milan), Poyales (Madrid), Tosti, Tinelli, and Tavolara (Rome), Strazzi (Bologna), Maione (Genoa), and others.

Professor J. Malbran of Buenos Aires gave the second paper on the "Surgery of astigmatism." Professor Malbran also

demonstrated with films the surgical treatment of keratoconus. For the astigmatism, he uses keratotomy according to Sato and modified by him. This technique may play an important role in the correction of this refractive error.

A symposium on "Toxoplasmosis" was presented by Bucalossi (Genoa), François (Ghent), and Franceschetti and Bamatter (Geneva). During the discussion, pertinent remarks were made by Grignolo (Parma), Durix and Gallet (Casablanca), Bonamour (Lyons), Tsopelas (Athens), Di Ferdinando and Filippi-Gabardi (Bologna), D'Ermo, Babudieri, and Ovary (Rome), Plum (Geneva), and others.

Surgical clinics were conducted by Arruga, Malbran, and Charamis at the Provincial Ophthalmological Hospital of Rome whose director is Prof. E. Leonardi. These clinics were followed by film presentations by Sourdille, Poyales, Pagani, Charamis, Arruga, Strampelli, and Grancini.

At a meeting of the executive committee on June 10, it was decided to hold the second congress of the society in Madrid in 1956. The topic for discussion at this meeting will be "The use of acrylic material in ophthalmology: I. In ocular surgery; II. In surgery of the orbit; III. In surgery of the lacrimal pathways.

The members of this first congress were granted an audience by Pope Pius XII who received them in the Sala del Concistoro. The Holy Father delivered a wonderful address in French, then in Spanish and Portugese, emphasizing the deep spiritual and moral values in ophthalmology.

A reception for the members was given by the Ministry of Foreign Affairs in the museum of the Gallery of Villa Borghese. Further cordiality was offered at private receptions, a cocktail party at the Hotel Hassler, sponsored by the arrangements committee of the congress, concerts, and excursions to various points of interest, at one of which, the excavations of Ostia Antica, the members were greeted by Prince Massino Lancellotti, president of the province of Turismo. The congress ended with a banquet on June 13 at the Grand Hotel, presided over by the Ambassador of Uruguay, Dr. Giambruno, who proposed a cordial toast to Latin friendship and civilization.

Jean Sédan,
Reporter.

Ophthalmic Miniature

If a person should look upon the sun, without blinking, he would soon lose his eyes. And, indeed, at the eclipse of the sun, a very great many who attempted to secure an all too exact observation of the phenomenon, and therefore gazed immovably at the sun, at last became completely blind, without at first perceiving that there was anything the matter.

Claudius Galen,
Anatomy and Physiology of the Eye, (circa 164 A.D.)
From the translation by Katz.

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THE CHICAGO CLINICAL CONFERENCE AND MIDWEST RESEARCH MEETING

More than 135 ophthalmologists and residents attended the annual clinical conference of the Chicago Ophthalmological Society February 5 and 6. In recent years a definite pattern has developed for this gathering, with the meetings being held in a centrally located hotel and the evenings not preempted, so that those attending may have time to organize notes, to review the lectures, or to see what Chicago has to offer in scientific endeavor after dark.

An annual feature is the Gifford Lecture commemorating the previous chairman of the Department of Ophthalmology, Northwest-

ern University, who passed away in 1943. This year Dr. Kenneth Swan of the University of Oregon once again demonstrated his versatility and competence, describing the blindspot mechanism. Since his initial description of this syndrome in 1947, many more cases have been analyzed and more rigid criteria of what constitutes the syndrome have been established. His paper was in keeping with the excellence of previous Gifford Lectures and was of considerable practical value. Following the lecture, Dr. Swan was honored at a reception sponsored by the Chicago Ophthalmological Society and was given the traditional cigarette box commemorating the event.

Earlier in the day, Swan spoke convincingly of his results with his recession procedure in which Tenon's capsule is opened over the central portion of the muscle. Dr. Alston Callahan of the University of Alabama delighted everyone with his surgical virtuosity and superb motion pictures demonstrating the care of entropion and ectropion and, the following day, the technique of cataract extraction following filtering operations.

Dr. Charles Iliff of the Wilmer Institute discussed the management of ptosis and his technique of dacryocystorhinostomy, illustrating his presentations with motion pictures. Dr. P. J. Leinfelder of the University of Iowa discussed metabolism of the lens, a subject about which he has spoken authoritatively for many years. Dr. Kenneth Ogle of the Mayo Foundation gave a truly impressive demonstration of teaching skill in putting across an understanding of physical and sensorial mechanisms of binocular vision and the use of prisms in vertical divergence.

The final morning a symposium on headaches was presented by a group of distinguished specialists each of whom discussed the problems of headache in his field. Dr. Percival Bailey described the physiologic mechanism of headache and was followed in turn by Dr. Boshes, Dr. Lederer, Dr. Leinfelder, Dr. Chandler, and Dr. Keeton who discussed headaches from the viewpoint of the neurologist and psychiatrist, otolaryngologist, ophthalmologist, orthopedist, and internist. The outstanding impression created was the ubiquitousness of headache and the large number without demonstrable organic basis.

On each of the two days, a round-table luncheon was participated in by all the speakers and registrants. By saving the questions till this time, a good exchange of ideas was obtained, particularly since the speakers also commented upon subjects of other speakers.

The Midwest Association for Research in Ophthalmology met the following day at the University of Chicago Medical School. Despite the hour which seemed doubly early on Sunday, some 60 participated in the meeting. It was particularly gratifying to note the presence of psychologists and biochemists who were working in the field of ophthalmology. The meeting was led off by Zeller of Northwestern who showed once again the active anaerobic metabolism of the vitreous. Schwartz and Leinfelder of the University of Iowa discussed metabolic studies of the lens epithelium in vitro, in which they have maintained lens epithelium in a roll of plasma for as long as nine days. Orzack and Schlaegel of Indiana University discussed the Liebmann effect in binocular perception. Ostler of the University of Iowa presented preliminary studies of the bacterial flora of the eye, nose, and throat in nongranulomatous and granulomatous uveitis. Thomas of the University of Chicago showed in great detail studies on the flicker fusion of the eye, and Trapp and Miles of Washington University showed the effect of variation in quality of target in this interesting field. Newell, Harper, and Koistinen of the University of Chicago discussed the effects of point sources of radium radiation on the posterior eye, using Yttrium-90. Hensen of Iowa presented the results of his studies on the after-image transfer tests in anomalous correspondence. Shoch and Puntenney of Northwestern University presented further studies suggesting that the aqueous

changes following irradiation of the eye were not primarily responsible for cataract formation.

Pushkin, Biegel, and Folk of the University of Illinois presented successful experiments in which a spongelike material, which has been used previously for an ocular implant, was used as a seton in rabbits. Bounds and Johnston of Iowa discussed the electroretinogram in choroideremia and Davis discussed the effect of partial avitaminosis A upon the electrogram.

The program was extremely well received and was stimulating both to the listeners and to the participants. Because of the informal discussions and presentations, the sectional meetings of the Association for Research perform an unusually useful function, bringing together researchers and clinicians with common interests, and affording a forum for preliminary reports.

Frank W. Newell.

XVII INTERNATIONAL CONGRESS OF OPHTHALMOLOGY

Montreal, Canada—September 10 and 11, 1954.

New York City—September 13 through 17, 1954.

Subjects for discussion: *Glaucoma* and *Uveitis*.

CORRESPONDENCE

Articles on "Child Behavior"

Editor,

American Journal of Ophthalmology:

Regarding the treatment of strabismus and myopia by exercises, we should like it known that the articles appearing in a syndicated newspaper column called "Child Behavior" and coming from the Gesell Institute of Child Development represent the views of this institute.

The Gesell Institute is a private organization located in New Haven, Connecticut, with no connection with Yale University or its Section of Ophthalmology.

(Signed) R. M. Fasanella,
Chief, Section of Ophthalmology,
Yale University School of Medicine,
New Haven, Connecticut.

Alfred Graefe and Albrecht von Graefe

Editor,

American Journal of Ophthalmology:

I read with great interest the fine and fair editorial on "German Ophthalmology" by Dr. Lebensohn in the January issue of The Journal. We have all to be grateful for such enlightenment. The actual incentive, seemingly, of Dr. Lebensohn's editorial was the centenary of the foundation of the *Archiv für Ophthalmologie* by Albrecht von Graefe. His tribute to one of the greatest ophthalmologists who ever lived is, in turn, a good occasion for me to write to you on a subject which—even if minor—has annoyed me many a time. I want to point at the periodically recurring references in the American ophthalmic literature attributing to Albrecht von Graefe contributions by another man who, by a whim of fate, not only was his contemporary, but almost his namesake, Alfred Graefe, professor of ophthalmology in Halle and an important ophthalmologist in his own right. Albrecht von Graefe was so great a man and so great a scientist that (as we say it in Hungarian) his fame need not be adorned with feathers from other men's hats. To the sorrow of all mankind, Albrecht von Graefe died of consumption in 1870, at the early age of 42 years. He could thus not have published what one of your Journal contributors of last year starts as ". . . Already in 1889, Albrecht von Graefe noted that . . ."

Albrecht von Graefe has done more than anyone in such short span of life could have done. His founding of the *Archiv* and of the *Ophthalmologische Gesellschaft* of Heidelberg are only the least of his achievements.

He was able, in one person, to be a saint, a scientist, and an organizer. Everyone knows of his contributions to the therapy of glaucoma, to cataract surgery, to the analysis and treatment of disturbances of ocular motility, and so forth, but the book on *Vision of the Squinters* was written by Alfred Graefe, not by him, and so was the classic monograph on the *Disturbances of Motility*, the standard work of the pre-Bielschowsky era which, in the *Transactions* of one of our national societies, I again found attributed to Albrecht von Graefe, just a few months ago. Moreover, the matchless and much quoted *Handbuch der gesamten Augenheilkunde* also had Alfred Graefe, not Albrecht von Graefe as its coeditor. The Germans call this handbook the "Graefe-Saemisch" which at least is not inaccurate. But it is inaccurate and unfair to the memory of Alfred Graefe, to refer to this work as the handbook of "von Graefe and Saemisch," or "A. von Graefe and Th. Saemisch," as I have found it so often in American references to his work.

I hope that the clearing up of this, in itself insignificant, matter will justify publication of my letter.

(Signed) Arthur Linksz,
New York.

BOOK REVIEWS

GRENZEN DES NORMALEN UND ANFÄNGE DES PATHOLOGISCHEN IM RÖNTGENBILDE DES SKELETTES (The Borderlands of the Normal and Early Pathological in the Skiagram of the Bony Structures). By Alban Köhler. Stuttgart, George Thieme Verlag, (Ninth edition, completely revised by E. A. Zimmer), 1953. 672 pages, 1,282 illustrations, table of contents, index, extensive bibliography. Price: DM 88.-

The Borderlands of the Normal and Early Pathological in the Skiagram is the title of Arthur Turnbull's English translation of the fifth edition (1928) of Alban Köhler's standard work. Radiologists may find it difficult to recognize an old and familiar standby in this new and completely revised edition. Zimmer actually has created an entirely new textbook. Based on more than 3,000 publications, the material is brought up to date. In the extensive bibliography, which is conveniently arranged in the form of footnotes, many older references are deleted in favor of more recent ones that appeared during the last two decades. Zimmer has so rewritten the text that some of the original observations by the older author are quoted as "according to Köhler."

After some general remarks, there are sections on the upper extremity, the shoulder and thorax, the skull, the vertebral column and the pelvis, and the lower extremity. The chapters concerning soft tissues, which amounted to almost one half of the contents of the older edition, have not been retained in the new volume. There still are a number of schematic drawings, but they are now greatly outnumbered by brilliant reproductions of positive X-ray plates.

The chapter of prime interest to the ophthalmologist is that on the skull. The enumeration of large numbers of publications in the ophthalmic literature indicates Zimmer's thoroughness in compiling references. The systematic treatment of the radiologic manifestations of the phakomatoses is very creditable. Likewise, ophthalmologists will be grateful for the inclusion of mandibulofacial dysostosis in which they share interest with the roentgenologist since Franceschetti and Klein's paper of 1949.

This textbook may be too general in scope to warrant a place in the personal library of the ophthalmologist. However, he certainly can make good use of it as a reference work if he will remember to look for it on the shelves of his hospital library.

Stefan Van Wien.

PHYSIOLOGY OF VISION. British Medical Bulletin, vol. 9, No. 1, 1953. Paperbound, 84 pages. Price: $2.75.

Recognition of the importance of visual

problems led the British Medical Research Council to establish a Physiology of Vision Committee 30 years ago, and its work has been continued by the London Institute of Ophthalmology directed by Sir Stewart Duke-Elder.

In the present symposium, Davson points out that no theory yet satisfactorily explains the formation and circulation of the aqueous; and Fincham shows that the Stiles-Crawford effect plays a part in the accommodation reflex.

In Sorsby's study of the nature of refractive errors, he emphasizes that the primary question is the nature of the correlating mechanism that produces emmetropia. Dartnall discusses the interpretation of spectral sensitivity curves; and Hartridge feels that a corrective retinal mechanism is operative in chromatic aberration which tends to eliminate not only the fringes produced by the refractive system of the eye itself but also those inherent in spectacle lenses and hand magnifiers.

Stiles details experiments based on the assumption that vision is served by several mechanisms having different spectral sensitivities to which may be referred the variety of color sensations experienced. Wright would include the testing of color vision in school medical inspections as an important aid to vocational guidance. Thomson concludes that the mechanisms for color are limited but that the visual pathway may be in various stages of activity. Weale holds that peripheral color vision is quantitatively poorer but not qualitatively different.

According to Pirenne, the considerable variability of response near the threshold of vision is mainly due to physical fluctuations rather than to biologic variations of sensitivity. Rushton is convinced from studies of the electric records from the vertebrate optic nerve that records from animals below the primate cannot be considered comparable to the human foveal pattern.

James E. Lebensohn.

MAY'S MANUAL OF THE DISEASES OF THE EYE. Revised and edited by Charles A. Perera, M.D.: Baltimore, Williams & Wilkins Company, 1953. Clothbound, 512 pages, 378 illustrations. Price: $6.00.

The present, or 21st, edition of this textbook represents a return of an old friend which first appeared in 1900. This book is so well established in the ophthalmic literature by general acceptance that no comment is necessary as to its value.

Actually the only comment necessary concerns changes in the present edition. Although the book is made no longer, there is added material on new therapeutic measures, particularly the hormones and antibiotics, on retrolental fibroplasia, and on certain surgical procedures. Also, although some old illustrations remain, the majority of these have been gradually replaced.

The new edition of this best seller keeps it in the fore as one of the most valuable ophthalmic texts available for general practitioners and medical students.

T. E. Sanders.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Riehm, W. **The influence of allergy on the pathogenesis of ocular diseases secondary to an infectious focus.** Klin. Monatsbl. f. Augenh. **123**:536-545, 1953.

The true metastatic infections of the eye are differentiated from those caused by an infectious focus which does not emit living organisms. This entity is explained as an allergic and not as a toxic reaction. (9 references)

Frederick C. Blodi.

Schmidt, R. **Damage to the optic nerve by pressure.** Klin. Monatsbl. f. Augenh. **123**:546-552, 1953.

The first patient was a 61-year-old man with symptoms and signs which were very suggestive of pituitary tumor. The operation revealed an extensive calcification of the internal carotid arteries.

The second patient was a 48-year-old woman with severe headache and temporal pallor of both discs. She had an internal frontal hyperostosis and an increased pressure of the cerebrospinal fluid. Both factors could perhaps account for the pressure atrophy of the optic nerves. Virility and obesity were present and make this then an instance of the Morgagni-Stewart-Morel syndrome. (1 figure, 7 references)

Frederick C. Blodi.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Auricchio, G. **Metabolism of the detached retina. Experimental research.** Boll. d'ocul. **32**:641-645, Nov., 1953.

Using Warburg's method, the author studied the respiratory rate and the glycolytic activity of rabbit retinas which were detached experimentally. There was no significant change in glycolysis but a constant and marked decrease of oxygen intake was found beginning a few days after the intervention. A table shows the values for control retinas, retinas after administration of hyaluronidase, detached retinas studied 10, 15, and 20 days after the intervention, and for the choroid of normal eyes and of eyes with detached retinas. (1 table, 9 references)

K. W. Ascher.

De Berardinis, Elio. **Ocular changes in rats following large doses of cortisone and desoxycorticosterone acetate.** Rassegna ital. d'ottal. **22**:441-451, Sept.-Oct., 1953.

Studies of ocular changes from large doses of cortisone and Doca in relation to disturbances of electrolite equilibrium showed the following—large doses of cortisone for two months produced general disturbances with changes in skin and hair, vascularization of the cornea and fine opacities in the vitreous. More marked alterations occurred after larger doses of Doca (desoxycorticosterone). Deficiency of vitamin K provoked only minimal changes. Diets rich in salt were fatal in a short time but with no appreciable ocular changes. Disappearance of lens opacities once formed were not observed. (2 figures, 20 references)

Eugene M. Blake.

Blaha, H., Wewalka, F., and Zwiauer, A. **Free amino acids in the aqueous of rabbits.** Klin. Monatsbl. f. Augenh. **123**: 552-555, 1953.

The amino acids in the aqueous were compared with those of the protein free serum by paper chromatography. Qualitatively and quantitatively no difference could be found in the two chromatograms examined in 15 rabbits. It can therefore be assumed that amino acids enter the aqueous by diffusion and not by active transfer. No peptides were found in the aqueous. (1 figure, 8 references)

Frederick C. Blodi.

Bocci, G. **Antiallergic action of cortisone.** Boll. d'ocul. **32**:681-688, Nov., 1953.

Guinea pigs were sensitized by peritoneal or subcutaneous injections of horse serum. Varying quantities of cortisone were added to the provoking injection and administered at varying intervals (one hour, 12 hours and 24 hours) after. The cortisone did not prevent the development of the anaphylactic shock. This is in agreement with the results of other investigators. (52 references)

K. W. Ascher.

Bonavolonta, G. **Investigations of lens opacities due to asphyxia in a confined space.** Arch. di ottal. **57**:369-393, Sept., Oct., 1953.

Asphyxia provokes lens changes in 25 percent of dogs and rabbits. The opacities appear 30 minutes after cessation of the asphyxia and disappear after 3 hours. Aqueous changes observed were augmentation of the CO_2 content, reduction of the oxygen and the chlorine concentration, but no alteration of the pH. The lens underwent a slight reduction of its respiratory activity. The oxygen lack seems to be the primary cause of the lens opacities. (8 figures, 5 tables, 17 references)

John J. Stern.

Burg, C., and Nordmann, J. **Determination of the freezing-point of the calf lens.** Ann. d'ocul. **186**:843-845, Sept., 1953.

The authors find the freezing-point of the calf lens to be $-0.514°$ and concur that the lens may be practically isotonic with the aqueous and the vitreous. It is certainly not hypertonic.

John C. Locke.

Colombi, C., and Cameroni, R. **The amino-acid content of the lens after irradiation.** Rassegna ital. d'ottal. **22**:485-490, Sept.-Oct., 1953.

The eyes of calves were irradiated shortly after death with a Hanau mercury vapor lamp containing a quartz bulb and with a current of 220 volts. The irradiation, which was given to avoid autolysis, led to an increase of the amino-nitrogen, even after a short exposure. The increase of amino-nitrogen is ascribed to a breaking down of the protein factor, similar to the results obtained by Labbé and

Lavagna in senile cataract and by Milano in cataracts of parathyroidectomized rabbits. (2 figures, 16 references)

Eugene M. Blake.

Dorello, U. **Study of the lens glutathione.** Boll. d'ocul. 32:646-650, Nov., 1953.

Thirty-five white male rats were grouped into seven lots, which were given the following treatments: 1. (control) subcutaneous water injections; 2. Two mg. of ACTH daily for five days; 3. Same, for ten days; 4. Three mg. of DCA daily for five days; 5. The medications 2 and 4 combined; 6. 0.20 cc. of 10 percent formalin solution daily for three days; 7. Four mg. of cortisone daily for 10 days. Twenty-four hours after the last treatment, the animals were exsanguinated, the eyes were rapidly enucleated, the lenses extracted, the ten lenses of each group were pooled, weighed and glutathione was ascertained according to the method of Fujita and Numata, as reported by Dorello in 1952. The values are tabulated and show that while after treatment with DCA the glutathione content of the lens of rabbits drops almost 25 percent it does not in rats. The same holds true for administration of high doses of ACTH, cortisone, and formalin. (5 references)

K. W. Ascher.

François, J., and Rabaey, M. **Histochemical studies of the mucoid of the cornea.** Ann. d'ocul. 186:901-917 Oct., 1953.

The mucoid of the cornea is basophilic and presents a metachromatic reaction with certain basic dyes. At the limbus, this metachromasia disappears abruptly and almost completely, which suggests that the corneal mucoid is connected with corneal transparency. Corneal vascularization was experimentally induced by intracorneal injections of turpentine and intracameral injections of alloxan. As vascularization occurred, the amount of mucoid was not decreased, but its concentration was reduced as the result of swelling of the corneal stroma. It is concluded that a high concentration of corneal mucoid prevents penetration of vessels. When the concentration is reduced, as by swelling, penetration of the vessels is made possible. John C. Locke.

Nano, H., Gilabert, N., Scenna, M., and Baron, H. G. **Vitamin E in ophthalmology.** Ann. d'ocul. 186:987-994, Nov., 1953.

The authors report favorably on the treatment with vitamin E, of diffuse sclerosis of the choroidal vessels (7 cases), macular degeneration (8 cases), degenerative myopia (11 cases), and papillitis and retrobular neuritis (5 cases). They review the pharmacodynamics of this therapeutic agent. (4 tables) John C. Locke.

Redi, Francesco. **Biochemical changes in preserved corneal tissue.** Rassegna ital. d'ottal. 22:464-471, Sept.-Oct., 1953.

After a short discussion of the more important characteristics of the mucopolysaccharides of the cornea, the author reports the result of a recent study of the behavior of the corneal mucoids in extracts of fresh and preserved corneas. The tissue was refrigerated at 2 and 4°C for 3 to 9 days, both with cornea isolated and in the eye. Results showed that regardless of the type or duration of preservation, the maximum precipitation of the mucoids occurred at pH4. The proportion of the mucoid decreased regularly with progressive length of preservation. (17 references) Eugene M. Blake.

Rosetti, D., and Borio, G. **The eye and systemic stress (experimental investigations of the blood-aqueous barrier). First communication: local conditions.** Arch. di ottal. 57:347-353, Sept.-Oct., 1953.

In a group of clinical investigations the behavior of the blood-aqueous barrier was studied in respect to certain anatomical-functional, congenital or acquired factors, such as anisometropia, coloboma, glaucoma, and trauma. It was found to undergo variations identical to those provoked by local application of histamine. (3 figures) John J. Stern.

Rossetti, D., and Borio, G., **The eye and systemic stress (experimental investigations of the blood-aqueous barrier). Second communication: trauma "in action."** Arch. di ottal. **57**:355-362, Sept.-Oct., 1953.

The behavior of the blood-aqueous barrier was observed during a period in which an accidental or surgical trauma was assumed to influence it. As already seen in experiments on animals' eyes, the blood-aqueous barrier showed the same alterations as in similar experiments with histamine and formaldehyde. The changes in the undamaged eye demonstrated certain aspects of the alarm reaction, in other respects the phenomenon of oculo-ocular reflexes could be recognized. (1 figure, 7 references) John J. Stern.

Rosetti, D., and Borio, G. **The eye and systemic stress (experimental investigations of blood-aqueous barrier). Third communication: trauma.** Arch. di ottal. **57**:337-346, Sept.-Oct., 1953.

Rabbit eyes were exposed to controlled trauma (injury to ciliary body with luxation of the lens in one group, simple contusion in another). The behavior of the blood-aqueous barrier in both eyes was followed and found to be very similar to that found in preceding experiments with histamine and formaldehyde. (6 figures) John J. Stern.

Rosetti, D., and Borio, G. **The eye and systemic stress (experimental investigations of the blood-aqueous barrier). Third communication: herpetic affections and spring catarrh.** Arch. di ottal. **57**:363-368, Sept.-Oct., 1953.

The behavior of the blood-aqueous barrier in some cases of herpetic infections and spring catarrh was studied. While the condition was active, the speed of exchange over the barrier was augmented; during treatment it was diminished; and after a cure was affected it became normal. (1 figure) John J. Stern.

Simkova, M., and Zahn, K. **The control of retinal circulation.** Ophthalmologica **125**:437-446, June, 1953.

Some of the systemic and ocular effects of epinephrine alone and in combination with hydergin (hydrogenated derivatives of the principal alkaloids of the ergotoxin group) were studied on one group of young normal individuals and on another group of individuals of advanced age with moderately severe hypertensive or arteriosclerotic cardiovascular disease. The effect of the drug upon the retinal circulation was estimated from the area of the physiological angioscotomas. Both groups of patients showed a decided increase in the size of the angioscotomas under the effect of epinephrine (.5 mg. subcutaneously). This was associated with the typical systemic effects of the drug. These effects, the ocular as well as the systemic ones, could be prevented by the administration of hydergin prior to the injection of epinephrine. The angioscotomas became even smaller than before the experiment. This reduction in size was more pronounced after hydergin plus epinephrine than after hydergin alone. No definite change in the caliber of the retinal arterioles could be observed during these experiments. They suggest that hydergin blocks the vasoconstrictor effect of epinephrine upon the retinal arterioles. An actual improvement of blood flow through the retina seems to result from the admin-

istration of hydergin. This effect is possibly further enhanced by epinephrine which would mean that the vasodilator effects of epinephrine are not blocked by hydergin. (7 figures, 7 references)

Peter C. Kronfeld.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Adelung, J. C. **A quick subjective check of the astigmatic correction.** Klin. Monatsbl. f. Augenh. **123**:584-589, 1953.

A new rotating chart has been devised which has in the center a grill of black lines forming 49 squares. Amount and axis of the cylinder can be determined. (6 figures, 7 references)

Frederick C. Blodi.

Bonavolonta, Guiseppe. **Motility of the crystalline lens in the aged physiologically deprived of accommodation.** Rassegna ital. d'ottal. **22**:452-463, Sept.-Oct., 1953.

The various theories concerning the act of accommodation are reviewed from the earliest to the most recent. The author then describes the technique by which he studied the behavior of the lens and the power of the ciliary muscle. The subjects varied in age from 20 to 85 years. The results of his observations demonstrated that in the young and middle aged subjects, there was an evident tremulousness of the reflex image from the poster lenticular surface during the effort to accommodate. This was less evident in elderly patients. Seventeen subjects were so studied and in 15 of them, the author demonstrated a movement of the lens when an effort was made to fixate a test object at a distance of five inches. (38 references) Eugene M. Blake.

ten Doesschate, J. **Observation on the entoptic foveal shagreen.** Ophthalmologica **126**:148-156, Sept., 1953.

The entoptic phenomenon of the foveal shagreen is elicited by a small moving light source acting upon the retina either through the anterior sclera or through the cornea and pupil. The phenomenon consists of a shiny shagreen-like appearance of the central area surrounded by an evenly illuminated and structureless periphery (except for the retinal vessel shadows). Study of the phenomenon under varying conditions has convinced the author that during movements of the eliciting light the vessel shadows and the foveal shagreen move in opposite direction to one another. That means that somewhere within the retina a phenomenon of reflection must take place. On the basis of estimates of the ratio between the movement of the light and the movement of the shagreen the author assumes that the nerve fibers of the cones are the reflecting elements. (3 figures, 9 references) Peter C. Kronfeld.

Dubois-Poulsen, A., and Deswartes. **Erythropsia.** Ann. d'ocul. **186**:777-803, Sept., 1953.

Within the erythropsias, two classes of phenomena must be distinguished: 1. snow erythropsia and erythropsia in aphakics or in patients with iris coloboma or albinism, which are due to an excess of luminous flux entering the eye; and 2. the phenomenon of erythropsia when an eye is bathed in sunshine (e.g., when printed letters appear red in the sunshine) which is due to the lateral illumination of the eye through the sclera. Erythropsia is often preceded by a stage of green vision which is difficult to explain. Neither the green nor the purple images are positive or negative after-images. Erythropsia is independent of the color of the excitant light and depends only upon its intensity. The purple vision can be experimentally produced. It seems that the classic laws have to do with a condition of the eye wherein the visual purple is only partially

utilized, without exhaustion of its reserves and therefore with a capacity for continuous and almost instantaneous regeneration. Erythropsia, on the other hand, would correspond to a depletion of the reserves of visual purple.

John C. Locke.

Enoch, J. M., and McGraw, J. L. **Contact lenses: some aspects of visual acuity and photophobia.** Am. J. Optometry 31: 12-28, Jan., 1954.

In this work, done at the Army Medical Research Laboratory, four brands of contact lenses were fitted by representatives of the respective companies to each of ten enlisted men. The contact lenses were tested under all sorts of conditions from kitchen police to parachute jumping, from forty below zero to 120° Fahrenheit. Very elaborate tests of visual acuity testing were used. The rate of haze and halo development was carefully traced, because it was considered an index of corneal change. In this experiment, the corneal contact lenses showed a low tolerance or wearing time. The ventilated fluidless corneal-scleral contact lenses were superior in wearing time and in visual acuity. These showed less corneal change than the fluid corneal-scleral lens.

Paul W. Miles

François, J., and Verriest, G. **Further contributions to the study of central scotoma in darkness in normal subjects.** Ann. d'ocul. **186**:1013-1041, Nov., 1953.

The authors have modified their technique of scotopic campimetry in such a way as to control the pupillary factor and the adaptation factor (absolute global threshold of the rods). In this way, they have been able to verify the exactitude of the laws of physiologic central scotoma in darkness, previously determined by them. They have also been able to fix the limits of the physiologic variations of the mean slope of the central scotoma and the corresponding adaptation curves. (15 figures, 5 tables, 40 references)

John C. Locke.

Graff, Th. **The range of accommodation through the distance correction.** Klin. Monatsbl. f. Augenh. **123**:577-584, 1953.

The point is reemphasized that measuring the near point while wearing the distance correction does not give the correct amount of accommodation. Curves are given which allow a quick calculation of the true value. (6 charts, 8 references)

Frederick C. Blodi.

Kuhl, A. **Increase in contrast perception with glasses impervious to ultraviolet.** Klin. Monatsbl. f. Augenh. **123**:590-594, 1953.

These glasses are practically colorless and yet absorb enough of the blue end of the visible spectrum to increase the contrast subjectively. (1 chart, 4 references)

Frederick C. Blodi.

5

DIAGNOSIS AND THERAPY

Agarwal, L. P., and Raizada, I. N. **Pyrazolon derivatives in the treatment of ocular conditions.** Ophthalmologica **126**: 110-116, Aug., 1953.

The article, coming from the department of ophthalmology of the Medical College of Agra, India, concerns itself with a pyrazolon (aminopyrine) derivative of the name irgapyrin which has analgesic, antipyretic and antiinflammatory action and very low toxicity. The authors report "most remarkable results" in postoperative, probably lens-induced, uveitis and favorable results in other forms of iritis as well as in keratitis. (2 references, 1 table) Peter C. Kronfeld.

De Alencar, Adroaldo. **Cortisone in**

ophthalmology. Rev. brasil. oftal. **12**:201-220, Dec., 1953.

After a brief review of the physiology of cortisone and ACTH and a short summary of the most important papers concerning their use in ophthalmology which have appeared in the United States, the author describes sixteen patients in whom he used these two substances. The lesions include hyphema, hypopyon, chorioretinitis, serous uveitis, iridocyclitis, and diverse forms of keratitis. In all cases the author claims to have had good results with both systemic and topical treatment. (1 table, 25 references)

Walter Mayer.

Bartley, S. H. **Understanding visual fatigue.** Am. J. Optometry **31**:29-40, Jan., 1954.

Dr. Bartley, a psychologist who has specialized in the study of fatigue, tells the clinician how to classify the symptoms given by patients related to visual fatigue. He emphasizes the psychosomatic approach.

Paul W. Miles.

Belfort Mattos, Rubens. **Therapy with products of tissue disintegration.** Rev. brasil. oftal. **12**:189-199, Dec., 1953.

Animal or vegetable tissues may be used, and the animal material may be homologous, heterologous, or autogenic. The most frequently used substances are placenta, eye, hair, cartilage, organs of internal secretion, leaves or vegetals, spleen, muscles, and brain. The author describes his method of obtaining and conserving products of tissue disintegration from animal and vegetable material. He uses these products as implants, retention enemas, or injections of aqueous suspension, which may be intramuscular, subcutaneous, subconjunctival, or retrobulbar. The author has used this therapy in many diseases such as blepharitis, keratitis, pannus of trachoma, keratoconus, iritis, choroiditis, different types of retinitis, neuritis, and optic atrophy, and claims to have had good results, with improvement of visual acuity. In cases of retinitis pigmentosa, which are hopeless in any case, he feels that this therapy does no harm. (1 table)

Walter Mayer.

Belmonte Gonzalez, José. **Attempts at stereoscopic biomicrophotography.** Arch. Soc. oftal. hispano-am. **13**:1046-1053, Sept., 1953.

A method utilizing the Zeiss slitlamp and an ICA camera adapted to the slitlamp is described. (12 figures)

Ray K. Daily.

Brito Oliveira, Décio. **Experiences with cortisone and ACTH.** Rev. brasil. oftal. **12**:221-230, Dec., 1953.

The author gives a brief summary of the discovery of these two products and refers to his first experience with cortisone manufactured by a Swedish laboratory, which he gave systemically combined with ascorbic acid, following the ideas of Brownlee. He then describes his experience with American ACTH and cortisone, recently made available in Brazil, in thirteen cases of keratitis, complicated cataracts, and uveitis. He had good results except in one case where the dose of ACTH was too great, and systemic manifestations of overdosage developed.

Walter Mayer.

Cavka, Vladimir. **Clinical and therapeutic results of tissue therapy.** Klin. Monatsbl. f. Augenh. **123**:680-702, 1953.

This report covers 551 patients. Placental tissue was injected subcutaneously, subconjunctivally and into the anterior chamber. Stomach tissue extracts were injected subconjunctivally and intracamerally. In other cases cod liver oil or whole blood was given intramuscularly. The retrobulbar injection of a brain suspension

from cadavers is new. This method is used for diseases of the optic nerve. (3 figures, 3 tables, 33 references)

Frederick C. Blodi.

Fazakas, Sándor. **New therapies for viral diseases of the eye.** Klin. Monatsbl. f. Augenh. **123**:710-722, 1953.

Two viral diseases are discussed. Herpes of the cornea is treated with vitamin B_1 and an antibiotic. For trachoma the author found that mechanical treatment (massage) combined with a sulfonamide or penicillin gives the best results. (22 references)

Frederick C. Blodi.

Kleifeld, O. **Ultrasound therapy of the human eye.** Klin. Monatsbl. f. Augenh. **123**:743-746, 1953.

On the normal eye the author experienced a corneal edema and mydriasis. In one case this therapy relieved intractable pain. Some improvement was noticed in three cases of vitreous hemorrhage. (9 references) Frederick C. Blodi.

Laiseca Negro, Juan. **Ocular prosthesis.** Arch. Soc. oftal. hispano-am. **13**:1064-1072, Sept., 1953.

The author advocates a prosthesis made to fill the entire conjunctival cavity, which can be obtained only by taking a colloid mold of the cavity. (2 figures)

Ray K. Daily.

Mitsui, Y. **Cerebrospinal pumping as a treatment of ocular angioneurosis.** Ophthalmologica **125**:458-462, June, 1953.

Cerebrospinal pumping is a term applied to a procedure that consists of repeated slow aspirations and reinjections of 5 cc. of spinal fluid. Each aspiration or reinjection should require about one and one half minutes. This is done about 20 times in one sitting. At the last time the spinal fluid is not reinjected. With this method the author has obtained "excellent results" in three cases of fairly severe and frequently recurring scintillating scotoma and in one case of retinal angiospasm. The method may be employed in angioneurotic conditions of the eye with every hope of obtaining a large percentage of cures. The mechanism of action of the pumping therapy is unknown, but probably it is a kind of shock-therapy. (2 references)

Peter C. Kronfeld.

De Toledo, Renato. **Observations in the use of hyaluronidase in ophthalmology.** Rev. brasil. oftal. **12**:231-235, Dec., 1953.

After a review of the pharmacology of hyaluronidase the author describes his own experience with hyaluronidase in akinesia and retrobulbar anesthesia. He obtained deep anesthesia and hypotension, which may be contraindicated in retinal detachment surgery and keratoplasties, but which is helpful in some cataract and glaucoma operations. He experimented with hyaluronidase combined with miotics for reduction of tension in glaucoma but it was completely ineffective except in one case in which the tension became uncontrolled by miotics twenty days after surgery (Elliot trephine) but in which 100 units of hyaluronidase subconjunctivally produced a lowering of the ocular tension. (6 references) Walter Mayer.

Vannini, A., and Pettinati, S. **Radiographic study of the venous orbital circle and the cavernous sinus.** Rassegna ital. d'ottal. **22**:500-516, Sept.-Oct., 1953.

The radiographic examination of the facial angle can be very helpful in the diagnosis of varices of the venous tributaries, and also some tumors of the orbit. Richly vascular tumors show opacification of veins and capillaries when properly injected, making clear the exact site and extent of the neoformation. Anomalies of the veins are clearly shown and collateral

circulation demonstrated. Six cases are described which illustrate the possibilities of injection of the venous system. (6 figures, 15 references)

Eugene M. Blake.

6

OCULAR MOTILITY

Sloan, P. G. **The cover test in clinical practice.** Am. J. Optometry **31**:3-11, Jan., 1954.

This is a review, complete description, and a discussion of the cover test for the diagnosis of motility errors. The cover test is objective and can be performed on small children with a precision of one or two prism diopters. Paul W. Miles.

7

CONJUNCTIVA, CORNEA, SCLERA

Abreu Fialho, Sylvio. **Some characteristics of the cadaver cornea.** Rev. brasil. oftal. **12**:167-172, Dec., 1953.

The author refers to the conservation of enucleated eyes for transplants, immersed in liquid paraffine and kept in the refrigerator at four degrees centigrade. With this method, the cornea frequently becomes cloudy, and to reverse this process, it is necessary to permit normal respiration to the cornea in the refrigerator by immersing only the posterior two thirds in paraffine. It is sometimes necessary to place eyes which have been in paraffine for several days in normal respiratory conditions for twenty-four hours before use, but this clarification of the cornea is associated with marked hypotony.

The author prefers to conserve the isolated cornea for perforating keratoplasties. He has found that when the cornea is kept in the refrigerator, a marked dehydration occurs, which after twenty-four hours may amount to a loss of three fourths of its weight. However, when it is immersed in Ringer's solution rehydration takes place, with a weight which after forty-eight hours of immersion is frequently greater than the initial weight. (9 references) Walter Mayer.

Alvaro, Moacyr, **Sulfhydril in the treatment of corneal affections.** Rev. brasil. oftal. **12**:287-292, Dec., 1953.

The author reviews the literature on the use of sulfhydril in the treatment of corneal wounds and burns. He mentions the role of sulfhydril in the physiology of the cornea and of the preocular fluid. He refers to the excellent results obtained in the treatment of corneal burns, ulcers, clearing of corneal opacities in a case of xerosis and in several cases of chronic conjunctivitis by the topical application of sulfhydril. (14 references)

Walter Mayer.

Amsler, Marc. **Pterygium causing corneal astigmatism.** Ophthalmologica **126**: 52-54, July, 1953.

The effect of pterygium upon the curvature of the cornea is beautifully shown in photographs of the corneal images of the Placido disc. Long before the pterygium actually invades the optical zone of the cornea, the curvature of the latter is altered by traction of the pterygium. Surgical removal of the pterygium eliminates this traction. (4 figures, 2 references)

Peter C. Kronfeld.

Friede, Reinhard. **The treatment and prophylaxis of the true pterygium.** Ophthalmologica **126**:161-167, Sept., 1953.

For early stages of pterygium the author recommends trephining, with a 1-mm. trephine, of the progressive edge and of the underlying cornea, removing approximately the anterior half of the latter. The resultant defect is allowed to heal by itself. This process of repair, in

the author's experience, prevents further progression of the pterygium. An alternative method is an incision of the cornea parallel with the limbus and just anterior to the head of the pterygium. The incision extends usually over two hours of the clock and about half way into the thickness of the cornea. The healing of this incision, again, puts an obstacle in the way of a progressive pterygium. In cases of recurrences the author dissects the entire pterygium from the cornea and sclera, removes all abnormal tissue from the undersurface of the conjunctiva and sutures a triangular lamellar corneal graft onto the bared sclera, with the apex of the graft toward the internal rectus insertion.

Peter C. Kronfeld.

Fronimopoulos, J., and Dimitriou, T. **Pterygium surgery.** Klin. Monatsbl. f. Augenh. **123**:722-727, 1953.

The pterygium is dissected back from the cornea into the angle. The sub-conjunctival tissue is excised. A flap of conjunctiva is pulled down from the upper segment and the conjunctiva is closed with silk. (8 figures, 3 references)

Frederick C. Blodi.

Gonzalez-Pola, Angel Moreu. **Surgery of keratitis.** Arch. Soc. oftal. hispano-am. **13**:978-990, Sept., 1953.

Fifteen cases of torpid keratitis of various types cured surgically are reported in detail. There were two chemical burns of the conjunctiva and cornea; two abscesses of the cornea; five cases of eczematous keratitis; three of recurrent corneal herpes; one of keratitis disciformis; one of corneal edema; and one of parenchymatous keratitis. The two surgical procedures used were perilimbal amniotic membrane grafts and lamellar keratoplasty; in some cases both procedures were done on the same eye. The author is enthusiastic about the results of these procedures, and advocates them warmly for all cases of acute keratitis which resist the conventional therapeutic agents. The technique of the two operations is described in detail. (7 figures) Ray K. Daily.

Landesman, R., Douglas, R. G., Dreishpoon, G., and Holze, E. **The vascular bed of the bulbar conjunctiva in the normal menstrual cycle.** Am. J. Obst. & Gynec. **66**:988-998, Nov., 1953.

The bulbar conjunctiva of 15 normal women was viewed daily with the biomicroscope and frequently photographed. It was found that conjunctival vascular changes, body weight, and body temperature varied with the menstrual cycle. In early menstruation the bulbar conjunctiva showed relative ischemia with arteriolar spasm and waves of constriction, narrow capillaries and venules, and slow blood flow. From the end of menses to ovulation the vessels were fuller and blood flow faster. During ovulation there was a slight ischemia. Toward the end of the cycle the vessels were engorged. A day or two before the onset of menses constriction began. Local sensitivity to epinephrine was also studied. (7 figures, 1 table, 17 references) Robert A. Moses.

Lepri, G., and von Berger, P. **Clinical contribution to the treatment of trachoma.** Rassegna ital. d'ottal. **22**:380-392, July-Aug., 1953.

After reporting the results obtained by the use of different antibiotics in the treatment of trachoma, the authors record the results obtained in 26 cases of recent trachoma, using the ointments of terramycin and of chloramphenicol, and combinations of the two. In 18 cases terramycin was applied to the right eye and chloramphenicol to the left, with equally good results in each. In 8 cases, chloramphenicol was administered to the right eye and given in doses of 30 mg. per Kg, with clearing in

both eyes. Terramycin is definitely efficacious in early trachoma and almost equal to chloramphenicol. (4 figures, 32 references) Eugene M. Blake.

Macdonald, Marguerite. **Case notes: Ps. Pyocyaneus eye infection.** Brit. J. Ophth. **37**:370-373, June, 1953.

An eye with a corneal ulcer with hypopyon which was caused by Ps. pyocyaneus improved promptly when polymyxin B was given topically and subconjunctivally. The action of the various polymyxins in ophthalmology is reviewed. Tissue destruction is usually present. Early recognition is necessary for treatment to be effective. (8 references)

Orwyn H. Ellis.

McGee, H. B., and Falls, H. F. **Hereditary polymorphous deep degeneration of the cornea.** A.M.A. Arch. Ophth. **50**:462-467, Oct., 1953.

Under slitlamp examination this type of dystrophy appears as a bilateral disturbance of the posterior one third of the stroma and the endothelium. It is characterized by the presence of endothelial concavities, vesicles and polymorphic opacifications. The authors believe it is a dominant hereditary and congenital trait. (3 figures, 9 references) G. S. Tyner.

Meitinger, A. **Ocular injury with potassium permanganate crystal.** Klin. Monatsbl. f. Augenh. **123**:493-494, 1953.

A 16-months-old child inadvertently got crystals of potassium permanganate into one eye. When seen at the clinic, one hour later, part of the conjunctiva and the lower segment of the cornea were dry and browned. There was a large central erosion. The necrotic part of the conjunctiva was sloughed off and healed completely. The lower segment of the cornea became temporarily cloudy but soon cleared. (5 references) Frederick C. Blodi.

Morawiecki, J. **The treatment of phlyctenular disease with privine-cibazol emulsion.** Ophthalmologica **126**:122-125, Aug., 1953.

As a palliative agent in the treatment of phlyctenular keratoconjunctivitis, which is very prevalent in certain parts of Poland, the author recommends a combination of the vasoconstrictor privine with the mildly antiinfective and antiallergic agent cibazol. (8 references)

Peter C. Kronfeld.

Nicolai, Heinz. **The use of rhodanates in phlyctenular keratoconjunctivitis.** Klin. Monatsbl. f. Aughenh. **123**:490-491, 1953.

The author treated successfully an unspecified number of patients with drugs containing thiocyanic acid. The drugs were given orally (otrhomin) and topically in a combination with amino acids (Amino-Weidnerit).

Frederick C. Blodi.

Purtscher, Ernst. **The clinical picture of keratitis nummularis.** Arch. f. Ophth. **154**: 207-223, 1953.

Several clinical cases of keratitis nummularis are described and two types are differentiated. The one type, presenting foci about 2 mm. in diameter, seems to occur in the keratitis nummularis of Dimmer, in keratitis herpetica and in herpes zoster ophthalmicus. The other type shows smaller but more numerous foci and seems often to be related to epidemic keratoconjunctivitis and keratitis superficialis punctata. A toxic product of a virus is considered the pathogenetic factor of the conditions. (6 figures, 10 references)

Ernst Schmerl.

Redslob, E., and Brini, A. **Proliferations of corneal endothelium and Descemet's membrane.** Ann. d'ocul. **186**:969-986, Nov., 1953.

Basing their views on a histopathologic

study of three globes, the authors describe three types of proliferation of endothelium with Descemet's membrane: 1. proliferation, topically, in the form of folds; 2. proliferation along a surface other than the cornea; and 3. formation of cysts in the anterior chamber. These observations have a triple interest: 1. the fact that the endothelium is accompanied by a structureless membrane lends support to the theory of the endothelial origin of Descemet's membrane; 2. the third observation shows that contrary to generally accepted opinion, certain cysts of the anterior chamber may come from proliferation of corneal endothelium and 3. the origins of certain glaucomas following perforating wounds or iridocyclitis may perhaps be due to an obliteration of the anterior chamber angle by a newly formed Descemet's membrane. (8 figures, 21 references) John C. Locke.

Reynon. **Herpetic keratitis and placenta: 31 cases.** Ann. d'ocul. **186**:728-748, Aug., 1953.

From observations in 31 cases of herpetic and metaherpetic keratitis, the author reports favorably on the use of subconjunctival placental implants, when used in the first stage of the keratitis, in addition to the usual treatments.

John C. Locke.

De Rezende, Cyro. **Partial penetrating keratoplasty in keratoconus.** Rev. brasil. oftal. **12**:173-185, Dec., 1953.

European authors advocate keratoplasty only when there is a large central leucoma. On the other hand, Castroviejo believes that keratoconus is one of the best indications for a perforating keratoplasty, and in the case of a very great keratoconus, he contemplates a two stage operation cauterizing the vertex of the keratoconus as the first stage. The author reports his experiences with a partial keratoplasty in such cases with which he has obtained good visual results. He uses a Franceschetti trephine and Elschnig suturing. (18 figures) Walter Mayer.

Romanes, G. J. **Treatment of established symblepharon with split skin homograft.** Brit. J. Ophth. **37**:236-241, April, 1953.

The author presents a technique for the repair of symblepharon with the use of stored homograft as a free Thiersch graft. These survive 2 to 3 weeks, are of correct thickness and are easily obtained in adequate quantity. There is no ultimate discharge and no long-term cosmetic factor to be considered. The grafted eyes are quiet in the postoperative period and subsequently the final healing is completed in a short time with a minimal formation of scar-tissue, because of the very rapid proliferation of the conjunctiva which covers the bare area during the necrotic stage. (12 figures, 1 reference)

Orwyn H. Ellis.

Rossi, A. **The purin exchange in spring catarrh.** Rassegna ital. d'ottal. **22**:406-414, July-Aug., 1953.

Rossi discusses the nucleoproteids and their importance in metabolism. This was studied by the intravenous injection of a solution containing uric acid, lithium carbonate and glucose in seven patients. The author concludes that vernal catarrh affects individuals of particular neuro-endocrine status, with pluriglandular disfunction and certain stigmata of a uric acid diathesis. (7 references)

Eugene M. Blake.

Salvi, G. L. **Histopathologic findings in familial congenital corneal opacities.** Boll. d'ocul. **32**:689-699, Nov., 1953.

A penetrating corneal transplantation was performed on a 23-year-old woman with familial congenital corneal opacities. Study of the removed disc revealed that the membrane of Bowman was absent,

Descemet's membrane normal, but the posterior strata of the corneal stroma showed a marked dissociation of the lamellae; no deposits could be characterized by different stainings. Near Descemet's membrane the lamellae were edematous. No signs of inflammation were found. (3 figures, 31 references)

K. W. Ascher.

Stallard, H. B. **Technique of lamellar scleral resection.** Brit. J. Ophth. **37**:223-228, April, 1953.

The author presents a modification of the technique of lamellar resection of the sclera and introduces three new instruments which he has found useful in its performance. Wide, extensive exposure is first described. The area to be resected is outlined with a scleral marker. The sclera is resected leaving the thin, innermost layer. Suturing and closure are described in detail. The results of surgery are presented. (7 figures, 1 reference)

Orwyn H. Ellis.

Swartz, J. **Case notes: retro-corneal hyaline bands in interstitial keratitis.** Brit. J. Ophth. **37**:374-375, June, 1953.

Retrocorneal hyaline bands may occur as congenital abnormalities, after birth trauma, and in eyes with longstanding iridocyclitis due chiefly to syphilis or tuberculosis. They are caused by a rupture of Descemet's membrane, by the formation of folds after the recession of the corneal swelling, or by a deposition of fibrin on the back of the cornea as a result of exudation from the iris. An eye is described in which the bands resulted from fibrin deposition in the anterior chamber; it was seen in a woman, aged 27 years, who had been under observation since she was 12 years old. (1 figure, 2 references) Orwyn H. Ellis.

v. Veelen, A. W. C., and Stibbe, P. D. **Parinaud's conjunctivitis and cat scratch disease.** Nederl. Tijdschr. v. geneesk. **97**: 1203-1205, May, 1953.

A case of Parinaud's conjunctivitis which occurred in 1948, when no diagnoses could be made, is described. In 1952 a positive reaction to the intracutaneous test with antigen against cat's scratch disease appeared. The author's think this virus was the cause of the disease.

G. H. Jonkers.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Adamantiadis, B. **The complex syndrome of recurrent uveitis with hypopyon.** Ann. d'ocul. **186**:846-856, Sept. 1953.

The author describes three cases of the complex syndrome of recurrent uveitis with hypopyon. The chief manifestations of this disease are: uveitis with hypopyon, aphthae of the mouth, ulcerations of the genitals, and thrombophlebitis affecting the ocular fundus or the lower extremities. The symptoms may appear separately, with an interval of several years between them. Cases occur which do not show the complete syndrome. (33 references)

John C. Locke.

Cross, A. G. **Sarcoidosis of the eye.** Brit. J. Ophth. **37**:247-250, April, 1953.

Sarcoidosis must be regarded as a tissue reaction to a foreign agent which is introduced into the body, possibly a hypersensitivity reaction. Typical cases of sarcoidosis show characteristic changes in the lymph glands, lungs, and eyes, as well as in other parts of the body, but consideration must be given to cases showing less typical and less widespread signs. No cause is found for many cases of uveitis, and in the presence of a negative Mantoux reaction the possibility of sarcoidosis should always be considered. The diagnosis is confirmed by the presence of enlarged lymph nodes, shadowing of the lungs in radiological films, a raised serum

globulin, the development of iris nodules, and by the large transparent peripheral keratic precipitates. Absolute proof depends upon the histologic appearances of an excised lesion. Tuberculin anergy in sarcoidosis is a constant finding. The use of cortisone appears to have been beneficial in some cases. (4 references)

Orwyn H. Ellis.

Davis, M. D. **Endogenous uveitis in children.** A.M.A. Arch. Ophth. **50**:443-454, Oct., 1953.

The results of a study of uveitis in children admitted to the Wisconsin General Hospital over a ten year period are reported. The author points out the close relationship between iritis and rheumatoid arthritis in contradistinction to the absence of iritis in rheumatic fever. Forty percent of the cases of uveitis in these children were associated with rheumatoid arthritis. (4 figures, 35 references)

G. S. Tyner.

François, J., and Rouck, A. **Hereditary aplasia of the iris.** Giorn. ital. oftal. **4**:309-315, July-Aug., 1953.

A case of bilateral aplasia of the iris in a girl, ten years of age, is described in detail; it is shown how the affection was inherited in a dominant fashion from the father. The aplasia involved both the mesodermal layers and the pigmented pupillary border. In this case, examination by the gonioscope revealed in the region of the angle embryonic mesodermal tissue similar to that found in congenital glaucoma. The author considers the condition an incomplete form of aniridia, and classifies it under the heading of "circumpupillary aplasia." The various forms of iris abnormalities are classified, and the article is illustrated by the pictures of the right and left iris, and by the gonioscopic appearance of the angle of the anterior chamber. V. Tabone.

Fuchs, A. **Tissue proliferation in the iris.** Klin. Monatsbl. f. Augenh. **123**:513-530, 1953.

The mesoderm of the iris does not proliferate under usual circumstances and defects in the iris usually do not heal. If such defects close, it is by an inflammatory exudate which may become organized. Tissue on the iris is either organized exudate or a layer of newformed vessels coming from the angle.

Stromal proliferations occur in two types. One is a thickening and proliferation of the dilator muscle. The other type consists of nodules of endothelial cells occurring in inflammations. Such nodules are inflammatory granulomas. E. Fuchs called them "nevus vasculosus," but they are obviously neither a nevus nor a vascular tumor. (6, partly colored figures, 1 chart, 9 references) Frederick C. Blodi.

Harley, D. **Allergic aspects of iridocyclitis.** Tr. Ophth. Soc. U. Kingdom **72**:419-430, 1952.

The prinicple of the pathogen-selective culture is the utilization of the in vitro bactericidal power of the patient's whole fresh blood to kill organisms to which he is immune and to allow the growth of potentially pathogenic organisms, thus allowing us to select the etiologically important organism from a mixed culture in cases of chronic or focal infection. Series of cultures were made from tonsils, nasopharynx, feces and urine, in the medium of the patient's blood, and the results of these cultures compared with results with a series of ordinary direct cultures prepared on routine culture media. Among 52 cases, one or two potentially pathogenic bacteria were able to withstand the bactericidal action of the patient's blood for 24 hours at a temperature 37° Centigrade.

Autogenous vaccines were prepared

from the positive pathogenselective cultures and administered subcutaneously, in a vaccine of two million heat killed organisms per cc. After three months a second vaccine made of four million organisms per cc. was given. It may be that these patients should have a course of such injections periodically for a number of years.

The result of this approach justifies the author's belief that in a fair proportion of these patients the uveitis was a manifestation of an allergic reaction.

Beulah Cushman.

Larmande, A. M. **Progressive and essential atrophy of the iris.** Arch. d'opht. **13**:586-602, 1953.

The author presents a well-illustrated, comprehensive analysis of the subject of essential atrophy of the iris. He discusses the evolution of the disease during three stages, first the stage of pseudocoloboma, second the stage of pseudopolycoria, and third the stage of aniridia. The complication of secondary glaucoma ordinarily appears late in the disease which evolves slowly. The prognosis of the disease is extremely poor and the syndrome almost always leads to blindness and sometimes to loss of the globe. Fortunately it is most often unilateral but six of the 52 published cases were bilateral. Larmande notes that gonioscopic examination was made on only seven of the published cases but that in all of these anterior synechiae were noted. He refers to the five-times-greater frequency of the disease in the female than in the male and notes that the cause is still unknown. Surgical treatment of the secondary glaucoma has generally been unsatisfactory. A complete bibliography is appended. (5 figures, 68 references)

Phillips Thygeson.

Marback, H., de Toledo, R., Guimarães, W., and Eliezer, C. P. **Symposium on uveitis.** Arq. brasil. de oftal. **16**:1-33, 1953.

In this symposium Marback summarizes the important knowledge of the etiology and of the etiologic diagnosis of uveal inflammations, and de Toledo discusses the clinical course and manifestations of such types as metastatic, anaphylactic, and purulent uveitis. Cataract and glaucoma secondary to uveitis are accorded most extensive consideration and the complicatory lesions that occur in cornea, sclera, retina, and optic nerve are given adequate attention in the contribution of Guimarães and Eliezer.

James W. Brennan.

Di Marzio, Q., and Strazzi, A. **X-ray treatment in uveitis.** Ophthalmologica **126**:1-15, July, 1953.

The senior author, di Marzio, was one of the pioneers in the field of X-ray treatment of uveitis. In the paper under review he and Strazzi report on their results in 880 cases. The technique which proved most effective was the following: four to six applications, five to six days apart, of 120 r of very hard rays (2mA, 170-180 kV, .5 mm. Zinc plus 3 mm. aluminum). This amount of radiation never caused any damage, especially no cataract. The X-ray therapy was given in addition to whatever local or systemic treatment seemed indicated. With regard to the probable etiology the 880 cases were classified as follows: tuberculous, 310; syphilitic, 75; rheumatic, 65; focal infection, 28; posttraumatic, 52; postoperative, 18; various rare infections, 19; and unknown etiology, 313 cases. In 45.5 percent of the entire material the authors attribute the final subsidence of all inflammatory symptoms to the X-ray therapy. In another 36 percent the disease took a more favorable course as the result of the X-ray therapy. In the remaining 17.5 percent the X-ray therapy failed to influence the course of the disease. The authors consider roent-

gentherapy useful in every form of uveitis. The course of the disease is shortened, sequelae are less frequent and less severe. There are fewer recurrences. X-ray therapy is definitely indicated and even indispensable in all chronic forms of uveitis (26 references)

Peter C. Kronfeld.

Mueller, Horst. **Phakogenetic ophthalmia with Morgagnian cataract.** Klin. Monatsbl. f. Augenh. **123**:405-417, 1953.

One specific situation among the various causes for a phakogenetic reaction is discussed, namely a preceding extracapsular cataract extraction in the first eye with hypermature cataract, defects in the lens capsule, uveitis with secondary glaucoma, and finally enucleation of the second eye. Two such cases are discussed from a pathologic point of view. Macrophages predominate in the cellular reaction. These cells also block the angle of the anterior chamber. The etiology of this anterior uveitis is either toxic, caused by the degenerated lens fibers, or allergic produced with the addition of some adjuvant. The practical implications are important. Faulty light projection was present in both cases and yet the retinas were intact; it is therefore not a poor prognostic sign. Cataract extraction is the method of choice and should be accompanied by the frequent local application of cortisone. Cataracts should be extracted before they become hypermature. The increased pressure outweighs the inflammatory signs and the anterior chamber is usually deep. (2 figures, 17 references)

Frederick C. Blodi.

Palich-Szántó, Olga. **A luetic-allergic iritis.** Klin. Monatsbl. f. Augenh. **123**:734-739, 1953.

A 45-year-old man had a unilateral acute iritis with a vesicle-like granuloma near the pupillary margin. The history revealed a luetic infection 20 years ago. All serologic reactions to syphilis are now negative. It is assumed that an allergy to syphilis was present which was precipitated by an unspecific allergen (raw eggs). (18 references)

Frederick C. Blodi.

Wolffersdorff, H. V. **Still's disease and iridocyclitis.** Klin. Monatsbl. f. Augenh. **123**:530-536, 1953.

Another patient with the typical band keratopathy is presented. Improvement followed tonsillectomy and the giving of penicillin. The eye signs are pathognomonic and therefore of great diagnostic importance. (1 chart, 13 references)

Frederick C. Blodi.

9

GLAUCOMA AND OCULAR TENSION

Agarwal, L. P., and Sharma, C. K. **Two provocative tests for glaucoma.** Brit. J. Ophth. **37**:330-335, June, 1953.

The authors used the jugular compression and the water-drinking tests on normal, glaucomatous, and pre-glaucomatous patients. In discussing this test the authors point out that it is possible that a regulatory reflex may act in defence against an acute impediment of venous circulation; it may be that this reflex fails to function in glaucomatous eyes. In the water-drinking test 600-1000 ml. are recommended and a very high percentage of positive results was found in the three types of glaucoma. Hemoglobin percentage was found to drop after 45 minutes. In chronic glaucoma no increase in blood pressure is found. It may be that hemodilution causing hypotonicity leads to an increased flow of aqueous in the eye and that in glaucoma this increase cannot be compensated for by the regular channels. Increased capillary permeability may play a significant part in the etiology of glau-

coma, especially the acute congestive type. (12 references) Orwyn H. Ellis.

Agg, Z. **Experiments to improve the results of trephining the sclera.** Szemészet **2**:68-70, 1953.

Having performed Elliot's trepanation in seven rabbit eyes and 14 glaucomatous ones the author placed a button made of plexiglass into the scleral opening in order to prolong the duration of the fistula. The longest persistence of button and fistula was 11 months. The button exerted a favourable action on tension as long as it was in place. No irritation was produced by the artificial substance.
Gyula Lugossy.

Day, R. M., and Scheie, H. G. **Simulated progression of visual field defects of glaucoma.** A.M.A. Arch. Ophth. **50**:418-433, 1953.

This study emphasizes the importance of properly evaluating glaucoma patients who show an apparent progression of visual field defects. The decrease in visual acuity brought about by the ciliary spasm and miosis following the use of miotics can cause a simulated glaucoma field defect or progression of existing defects. Similarly, the presence of an advancing nuclear cataract may produce an apparent progression in the field defect. Failure to recognize these factors may lead to unnecessary surgery. (9 figures, 10 references) G. S. Tyner.

Forgács, J. **Data referring to the mechanism of the action of compounds lowering ocular tension.** Szemészet **4**:159-153, 1953.

By means of the "fluorescein instillation test" the action of a group of compounds lowering ocular tension was examined. The action of pilocarpin was, especially in cases of high tension, biphasic. First the canal's egress was opened, then the secretion of the aqueous fluid was increased. The difference between pilocarpin and eserin consists in the fact that the latter does not give rise to increased secretion of the aqueous fluid. Adrenalin acts by diminishing secretion. Moderate pressure applied to the eye results in the escape of the aqueous humor whereby the ocular tension decreases. Gyula Lugossy.

François, Jules. **The persistence of embryonic mesodermal tissue in the iridocorneal angle of eyes with congenital glaucoma or other malformations.** Ann. d'ocul. **186**:804-819, Sept., 1953.

Congenital glaucoma is a geno- or phenotypical malformation of the globe, characterized first of all by the persistence of an embryonic mesodermal tissue in the iridocorneal angle and then by the absence, the malformation, or the malposition of Schlemm's canal and by a hypoplasia of the uvea, which are accompanied in varying degrees by an increase in tension and in the dimensions of the globe. Congenital glaucoma may be classified as complete congenital glaucoma with early or late development, and as incomplete congenital glaucoma, the latter being characterized by the absence of ocular hypertension. Gonioscopic verification of embryonic mesodermal tissue in the angle allows one to differentiate congenital glaucoma from megalocornea, since many cases described as megalocornea are really cases of incomplete congenital glaucoma.

Anomalies of the chamber angle are not sufficient to resolve the problem of the pathogenesis of congenital glaucoma. Certain other congenital anomalies of the anterior segment such as aniridia, coloboma or aplasia of the iris, and microphthalmia, also show an abnormal persistence of embryonic mesodermal tissue in the iridocorneal angle. This and the fact that they can all be complicated by ocular

hypertension and be associated amongst themselves, shows that a certain correlation exists between them, which demonstrates their dependence on the same hereditary genotypic factor.

John C. Locke.

Guist, G., and Steffen, C. **Vitamin D therapy in glaucoma.** Klin. Monatsbl. f. Augenh. **123**:555-568, 1953.

Vitamin D injections proved to be of some benefit in 45 patients with various types of glaucoma. A dehydration effect is assumed. (7 charts, 23 references)

Frederick C. Blodi.

Kleinert, Heinz. **The visible outflow of aqueous in glaucomatous eyes after intracameral injection of fluorescein.** Klin. Monatsbl. f. Augenh. **123**:653-680, 1953.

The author reports a continuation of his studies on the injection of fluorescein into the anterior chamber of human eyes. All the aqueous veins can then be seen with the slitlamp and ultraviolet light. During an acute attack in narrow angle glaucoma the number of aqueous veins is reduced and their caliber narrowed. The situation is normalized after an operation or with miotics. In wide angle glaucoma the number of aqueous veins is usually within normal limits (5 to 14). After a well-functioning fistulation operation their number decreases.

A decrease of outflow is the cause of primary glaucomas and no data could be found by the author which would incriminate hypersecretion for the increased intraocular pressure. It is assumed that an ischemic edema at the limbus presses on the intrascleral veins and increases the resistance to outflow. This ischemia may be caused by an angiospasm in narrow-angle, and by a vascular sclerosis in wide angle glaucoma. (9 figures, 5 tables, 24 references) Frederick C. Blodi.

Leydhecker, W. **A new provocative test for glaucoma.** Klin. Monatsbl. f. Augenh. **123**:568-577, 1953.

This is the third report (Klin. Monatsbl. f. Augenh. 121:412 and 513) on the use of a new vasodilator "Vasculat" for a provocative test. The drug is injected subconjunctivally so that the eye is tested directly and the fellow eye may serve as a control. The reliability of a provocative test is measured by the percentage of positive results (increase in pressure of more than 12 mm.) among patients with a chronic glaucoma who had no operation. The reliability of the water drinking test, the most valuable of the older tests, is 30 to 40 percent. The new provocative test has a reliability of nearly 90 percent. The action is probably the result of an acute and intense dilation of the episcleral and conjunctival vessels. The aqueous veins are filled with blood and this reflux of blood will throw an eye with poor facilities for outflow out of balance. (5 charts, 16 references) Frederick C. Blodi.

Lukic, D. J. **A new procedure of iridencleisis.** Arch. d'opht. **13**:478-485, 1953.

Lukic describes his favorable experiences with the iridencleisis operation but raises a number of objections to the operative procedures currently in use. He mentions the unfavorable effect of the change in the shape of the pupil, first on the appearance of the eye, and then on its physiologic function as related to the regulation of light, to spherical and chromatic aberration, and to the lower parts of the visual fields. He has devised a technique of iridencleisis by which a round pupil is preserved. An oblique iridotomy is performed, with preservation of the sphincter, and the tongue of iris is carried into the wound. In all but one of 10 reported cases the pressure was normalized without the use of miotics. Good filtering scars were obtained in all cases.

The author considers the basal coloboma essential to the achievement of the hypotensive effect. (5 figures, 7 references)

Phillips Thygeson.

Merte, Hanns-Juergen. **The mechanism of Elliot's trephining operation.** Arch. f. Ophth. **153**:197-206, 1953.

A reëxamination of more than 100 patients two years or longer after surgery showed a satisfactory fistula in about 75 percent. A slightly larger percentage had normalized tension. The importance of good fistulation is emphasized. The neurovascular shock set by the surgical procedure might temporarily play a role in the normalization of the tension. (4 references)

Ernst Schmerl.

Niedermeier, Siegfried. **The function of the choroid and primary glaucoma.** Arch. f. Ophth. **154**:86-95, 1953.

The author discusses the role of the ciliary muscle having the function of a tensor choroideae. Its stimulation is said to improve the choroidal circulation and the outflow of the blood from the eye. Surgery for glaucoma probably produces a neurovascular shock with diminished circulation within the choroid followed by a decrease of the ocular tension. (1 figure, 9 references)

Ernst Schmerl.

Nonnenmacher, H. **The combined dark-room-water drinking provocative test.** Klin. Monatsbl. f. Augenh. **123**:739-743, 1953.

This combined test gave more positive results than any single test in 38 patients. (16 references)

Frederick C. Blodi.

Radnót, M., and Török, É. **The action of thyreotropic hormone on ocular tension.** Szemészet **3**:105-106, 1953.

In experiments carried out with nine rabbits, thyreotropic hormone did not lower the ocular tension. The lowering of ocular tension observed in hyperthyreosis is not due to a direct action of the thyreotropic hormone.

Gyula Lugossy.

Sédan, Jean. **Homatropine and ocular hypertension.** Ann. d'ocul. **186**:995-1000, Nov., 1953.

The author reviews the literature on ocular hypertension and other complications occurring after the instillation of homatropine. He reports a single case where a rise in ocular tension from 23 to 39 mm. Hg (Schiøtz) occurred after four instillations. (10 references)

John C. Locke.

Segal, P., and Majkowski, J. **Electroencephalography in glaucoma.** Klinika Oczna **23**:101-112, 1953.

126 encephalograms were taken in 89 patients with glaucoma. There were 27 cases of simple glaucoma, 15 of acute glaucoma, 27 of the chronic congestive form and 20 of secondary glaucoma. In 36 patients with primary glaucoma the alpha wave was either absent or below the 20 microvolt amplitude. The beta wave was dominant in these cases. The results were equal from both hemispheres regardless of whether glaucoma was binocular or monocular. The encephalograms were not characteristic of glaucoma and were only reflecting some process in the cerebral cortex. In 15 cases which showed clinical improvement there was an increase in frequency and amplitude of the alpha wave. In secondary glaucoma encephalograms were normal. The authors consider that in primary glaucoma there are stimuli which originate outside of the eyeball and affect the cortex by reducing the alpha wave. (5 figures, 7 tables, 17 references)

Sylvan Brandon.

Stankovitch, Miodrag. **Subconjunctival injection of sterile air in fistulizing opera-**

tions. Ann. d'ocul. **186**:857-860, Sept., 1953.

The authors prefer air to anesthetic solutions for subconjunctival injections in filtering operations. They feel that air gives a better anatomical separation of the conjunctival flap from the sclera, that there is less chance of tearing the flap, and that bleeding is less, especially in congestive cases. For anesthesia they confine themselves to the local use of cocaine drops and feel that the air itself may have a slight anesthetic effect.

John C. Locke.

Velissaropoulos, P. **Cycloelectrolysis of the ciliary body in the operative treatment of glaucoma.** Ann. d'ocul. **186**:888-895, Oct., 1953.

Cycloelectrolysis is a relatively easy operation, which does not produce severe postoperative reactions. The types of glaucoma which lend themselves best to this operation are simple glaucoma and glaucoma following cataract extraction. Cycloelectrolysis can be repeated several times on the same eye, which allows normalization of tension in refractory cases, such as those secondary to iridocyclitis. Cycloelectrolysis can be carried out on eyes already operated on unsuccessfully by other methods. In agreement with Berens' findings, at least 40 perforations should be made at each operation. Simultaneous puncture of the anterior chamber does not improve the results. These conclusions are drawn from a study of the results of 42 cycloelectrolysis operations. John C. Locke.

Weekers, R., and Delmarcelle, Y. **Ocular hypotony due to reduced aqueous flow.** Ophthalmologica **125**:425-437, June, 1953.

The rate of flow through the anterior chamber was estimated by measuring, in situ and in vivo, the rate of disappearance from the anterior chamber of fluorescein instilled into the conjunctival sac (cfr. Langley and McDonald, Brit. J. Ophth. 36:432, 1952). The range of physiological variations was determined by measurements on 20 normal human eyes. A very much reduced flow of aqueous was observed in two eyes with hypotony following retinal separation, in one eye with acute hypotony of undetermined cause and in one eye with hypotony following retrociliary diathermy (for the relief of glaucoma secondary to cataract extraction). The counterpart to these cases of hypotony due to reduced flow was a case of hypotony following iridencleisis for the relief of chronic noncongestive glaucoma. There the rate of flow through the anterior chamber was markedly increased, apparently because of very low resistance to outflow. (7 figures, 18 references)

Peter C. Kronfeld.

Weekers, R., Delmarcelle, Y., and Prijot, E. **Pathogenesis and treatment of changes in ocular tension in uveitis.** Ann. d'ocul. **186**:876-886, Oct., 1953.

Tonographic measurements show that the majority of cases of ocular hypertension in uveitis are due to an increase in resistance to aqueous outflow. Gonioscopic findings in these cases are unreliable and cannot be correlated with the tonographic measurements. In a small proportion of cases, the increased intraocular pressure is due, wholly or partly, to increased aqueous humor formation. All instances of hypotension in uveitis are due to decreased aqueous humor formation. In some cases of uveitis with normal tension, increase in resistance to outflow is compensated for by decreased formation.

Atropine and cortisone diminish the resistance to aqueous outflow and normalize the tension in the majority of cases of uveal hypertension of recent onset. Retrociliary diathermy reduces ocular tension by diminishing aqueous humor formation and is effective even when increased resistance to aqueous outflow is irreduci-

ble. This operation is indicated whenever atropine and cortisone are not sufficient to normalize the ocular tension.

John C. Locke.

Weekers, R., and Prijot, E. **The differential diagnosis between chronic simple glaucoma and noninflammatory congestive glaucoma.** Ann. d'ocul. **186**:596-601, July, 1953.

Gonioscopy, tonography, and tension curves are useful in the differential diagnosis between chronic simple glaucoma and non-inflammatory congestive glaucoma. In chronic glaucoma the iridocorneal angle remains open even when the tension is highest; in congestive glaucoma it is closed when hypertension is present. In chronic glaucoma resistance to aqueous outflow is increased early and remains high; in congestive glaucoma the resistance is very high during hypertension, but returns to normal between hypertensive crises. Diurnal tensional variations are greater in congestive glaucoma than in chronic glaucoma. John C. Locke.

Wegner, W. **Thoughts on glaucoma.** Klin. Monatsbl. f. Augenh. **123**:641-653, 1953.

Wegner offers some generalizations on old glaucoma problems. In general, the author seems to favor conservative over operative treatment of glaucoma. The importance of gonioscopy is emphasized. Some of the miotic drugs are mentioned and the action of DFP is explained. For narrow angle glaucoma the author prefers the iridectomy ab externo.

Frederick C. Blodi.

Weinstein, P., and Forgács, J. **The daily changes of ocular tension.** Szemészet **2**:65-67, 1953.

The pressure of the cubital vein displays characteristic daily changes (it is lower in the morning) which in the majority of cases are parallel with the filling conditions of the episcleral aqueous veins. In inflammatory glaucoma the venous pressure is higher in the morning. The reactive hyperemia measured at the fingertips shows diurnal variation and this change probably is similar to changes of the intraocular capillary bloodflow. All these daily changes of rhythm are regulated by a central mechanism.

Gyula Lugossy.

10
CRYSTALLINE LENS

De Silveira, J. B. **Amino acids and allergenic extracts of the crystalline lens in the treatment of cataract.** Arq. brasil. de oftal. **16**:34-47, 1953.

Patients who react abnormally to the injection of lens allergens have a difficult postoperative course after cataract extraction and are prone to have more complications than the "normergic." The role of lens protein in the etiology of endophthalmitis phako-anaphylactica, and the irritation produced by injection of lens extracts in certain individuals are the basis for this investigation. Testing was done with extracts of lenses of sheep, cattle, and fish. Treatment was confined to fish lens preparations, either protein fractions or amino acids of the fish lens. The antigenic properties of hydrolyzed fish-lens protein are highly differentiated and evoke phakolytic substances and a trophic action of conjugated proteins (mucoproteins) which exist in lenses of fish. Mucoproteins seem to have a beneficial effect upon the nutrition of avascular organs. Antiallergic therapy with lens extract is based upon several principles: 1. reduction of reagins in the serum by a process identical with minimal anaphylactic shock ("disallergy"), 2. desensitization with increasing doses of specific antigenic substances (in this series), and 3. nonspecific foreign protein therapy. The role of galactose in the etiology of cataract is discussed. The author indicates that extracts of the

crystalline lens possess the ability to desensitize patients with endophthalmitis phako-anaphylactica, and have curative power in cataract of anaphylactic origin, incipient senile cataract, and traumatic and postoperative cataract. The addition of amino acids from the lens to the extract is believed to enhance the effect, although further observation is necessary. Patients treated are listed in a table, indicating also age, type of cataract, number of injections and visual acuity before and after treatment. (23 references)

James W. Brennan.

Haft, A. S. **Idiopathic hypoparathyroidism and cataract.** A.M.A. Arch. Ophth. **50**:455-461, Oct., 1953.

Idiopathic hypoparathyroidism is relatively rare. Cataract occurred in 50 percent of the 52 cases reported in the literature. Four new cases of idiopathic hypoparathyroidism with cataract are reported. From the author's description of the cataracts they seem similar to senile cataracts, i.e., anterior and posterior subcapsular opacities with nuclear sclerosis. (14 references)

G. S. Tyner.

Hunter, D., and Lister, A. **Mercurialentis.** Brit. J. Ophth. **37**:234-235, April, 1953.

The eye of a worker long exposed to mercury is described. With exposure of over five years many workers show a brown reflex of the anterior capsule of the lens. Some also showed fine punctate lens opacities and vascular changes at the corneoscleral junction. Merchurialentis may be the only sign and is permanent. (3 figures, 1 colored plate, 3 references)

Orwyn H. Ellis.

Jonkers, G. H. **Intraocular acrylic lenses. A case report.** Ophthalmologica **126**:55-57, July, 1953.

The author reports his first experience with a Ridley implant. On January 17, 1952, he performed a typical and uncomplicated extracapsular extraction of a traumatic cataract on a 33-year-old man and inserted an original, Rayner-made, acrylic lenticulus. The postoperative course was characterized by a chronic uveitis of gradually increasing severity. Six weeks later, after a consultant had recommended enucleation, the author removed the implant. The recovery was slow. Nine months later the eye was quiet and the corrected vision was 20/40. The patient and 15 other individuals gave negative skin reactions to the plastic of which the lenticulus was made. No effect of the same plastic upon tissue cultures of osteogenetic cells could be observed. These tests, in the author's opinion, do not rule out the possibility of an unusual degree of sensitivity to the plastic material present in some individuals. Insertion of a plastic lens may be a very attractive and satisfying technique, but it is obvious that one can meet unsuspected and severe difficulties. (1 reference)

Peter C. Kronfeld.

Mueller, Horst. **The morphology of the phakogenetic reaction of the human eye.** Arch. f. Ophth. **154**:224-243, 1953.

A phakogenetic reaction might exist where nothing but lens material is found as the probable pathogenetic factor. The author studied the morphologic phenomena of this type of inflammatory response. An examination of 35 enucleated eyes seemed to reveal nothing characteristic, however, except the regular occurrence of the rupture of the lens capsule. (7 figures, 6 references)

Ernst Schmerl.

Qurin, Alexander. **The treatment of cataracts without operation.** Klin. Monatsbl. f. Augenh. **123**:491-493, 1953.

These are additional remarks to a short report by R. Schmidt (Klin. Monatsbl. f. Augenh. 121:198, 1952). Qurin does not believe that extracts of infantile animal lenses have any influence on the development of cataracts in man. If the patient is very apprehensive iodine and vitamins can be prescribed in the early stages.

Frederick C. Blodi.

Ridley, Harold. **Further observations on intraocular acrylic lenses.** Tr. Ophth. Soc. U. Kingdom **72**:511-514, 1952.

The author reports on the use of the intraocular acrylic lens in 50 patients. In ten, lens extraction was intracapsular by intent or accidentally. It was necessary to remove the acrylic lens in three, in two others the lens slipped downwards, in another the acrylic lens was removed immediately because it did not ride on the face of the vitreous. Beulah Cushman.

Sakic, D. **Intracapsular cataract extraction.** Klin. Monatsbl. f. Augenh. **123**:727-733, 1953.

A preplaced conjunctival suture is used. The iris is pulled upward at 12 o'clock with a hook and the capsule is then grasped with an Arruga forceps near the equator above, always using the left hand for the extraction. The right hand uses the hook and then the other end of the same instrument, an Arruga expressor. (7 figures, 14 references)

Frederick C. Blodi.

Schirmer, R. **Expulsive hemorrhage after cataract extraction.** Klin. Monatsbl. f. Augenh. **123**:594-595, 1953.

One case is described in which coughing and a goitre were probable factors influencing the situation. Expulsive hemorrhage occurs in one-tenth to one-half of one percent of all extractions. (1 chart, 8 references) Frederick C. Blodi.

11

RETINA AND VITREOUS

Appelmans, M., and Carlier, E. **Alterations of the vitreous body associated with iridocyclitis.** Arch. d'opht. **13**:577-585, 1953.

The authors discuss in detail the chemical and physical nature of the vitreous and adopt the opinion advanced by Koby that the structure is more than a gel and less than a tissue. They further discuss the changes in the vitreous related to uveitis, particularly as made evident by biomicroscopy, and refer especially to the report of Dejean and Gassenc in 1950 on the clinical and biomicroscopic aspects of their so-called "tuberculous hyalitis." They confirm the occurrence of this entity which is characterized by the appearance in the membranous and filamentary planes of the vitreous of white particles varying in size from small to large. In old, resistant cases pigmented particles, yellowish or golden, are seen. This pigmentation must be differentiated from that seen in the lens capsule or on the hyaloid due to any non-specific iridocyclitis and which does not carry the unfavorable prognosis of the tuberculous type.

Appelmans and Carlier extend their study to include alteration of the vitreous in rheumatismal iridocyclitis and note the occurrence of a "plasmoid" vitreous in which there is swelling of the fibers, and numerous dust-like opacities appear in the vitreous in its liquid phase. In extreme cases the vitreous was transformed into a thick coagulum. Analysis of the aqueous revealed an increase in the level of plasma proteins with very few white cells. Pigmented granules later appear in the vitreous. The vitreous changes are more marked in young subjects.

The authors note that pure iritis does not alter the vitreous body and they stress

the importance in unilateral cases of iridocyclitis of comparing the pathologic vitreous with that of the normal eye. (4 figures, 16 references)

Phillips Thygeson.

Bailliart, P. **Pathological considerations of the retinal arterioles.** Ann. d'ocul. **186**: 577-584, July, 1953.

The subject is considered from anatomic and functional viewpoints. No attempt is made to furnish new facts.

John C. Locke.

Basterra, J. **Scleral resection combined with diathermy in the treatment of cases of retinal detachment with a poor prognosis.** Arch. Soc. oftal. hispano-am. **13**: 943-977, Sept., 1953.

A thorough review of the literature and a detailed description of the technique of the operation is followed by an analysis of the author's material, which comprises 18 operations on 17 eyes of 16 patients. One eye was operated upon twice. Eight of these were cured, and nine are classified as failures, although some of them were cured partially. Among the successes were two highly myopic eyes, and two patients with only one eye. Among the failures was one aphakic eye, two patients with only one eye, and one eye which was made worse by the operation. The conclusion which emerges from a review of these cases is that the results are better and failures fewer in cases in which this procedure is the first operation. Of the eight cured cases, this operation was the primary operation in five; among these are the two cases of high myopia; in three the operation was secondary following failure of a diathermy coagulation; among these are the two cases with only one eye. Among the nine failures this procedure was the primary operation in four cases, which include three of partial cure; in five the operation was secondary, and in this group there was one eye which improved. The indications for this operation are detachments with retraction of the retina or vitreous, including detachments following perforating injuries with organization of the vitreous, or following organized vitreous hemorrhages; detachments older than six months, with or without a tear; detachments with nystagmus, high myopia and aphakia; detachments with large or multiple tears; failures following diathermy coagulation; and detachments in old people in whom early mobilization is essential. (9 figures, 22 references)

Ray K. Daily.

Bottoni, A. **Considerations on the therapy of diabetic retinopathy.** Giorn. ital. oftal. **4**:332-334, July-Aug., 1953.

The literature on the treatment of diabetic retinopathy is reviewed and an outline of the pathology of the condition given. Of 115 patients 19 were treated with the lipotropic factor of the pancreas, 10 with methionine and choline, 4 with substances capable of releasing the methyl radical and which protect the liver, 20 with vitamin B, 35 with rutin, 7 with vitamin P, 10 with vitamin E, and 10 with testosterone. Only 9 (7.8 percent) showed some improvement; although the amount of exudate diminished, it disappeared in only one case. Vascular changes and hemorrhages remained unaltered. Fifteen patients became worse during the period of observation (28 months), and of these, five had been treated exclusively with rutin. This drug was found to give the least response while the substances with a lipolitic action gave the most favorable results. While there is no specific remedy for the condition, the means at our disposal, including insulin, should nevertheless be used to prevent further damage to the retina. Even though these substances are incapable of influencing the established retinopathy in the majority of cases, they may prevent its onset if given prophylactically. V. Tabone.

Csapody, I. **Scleral resection in cases of retinal detachment.** Szemészet **4**:145-150, 1953.

The observations made on 15 scleral resections justify the conclusion that this procedure is to be recommended for retinal detachment. In malignant cases any other operation should be preceded by scleral resection combined with diathermy. Gyula Lugossy.

Doggart, J. H. **Crystals in the posterior segment of the eye.** Tr. Ophth. Soc. U. Kingdom **72**:357-366, 1952.

Cholesterin and endogenous crystals are found more often in the posterior segment than in the anterior segment of the eye. Cholesterin is a key substance in biochemistry and is of concern in neurology, endocrinology and general medicine as well as ophthalmology. The literature and terminology of synchisis scintillans and asteroid hyalitis is reviewed.

Beulah Cushman.

Farnarier, G., and Sobrepere, G. **Systemic elastorrexia. (Angioid streaks, pseudoxanthoma elasticum, arterial elastic degeneration.)** Arch. d'opht. **15**:472-477, 1953.

The authors report a typical case of the Groenblad-Strandberg syndrome in a woman 40 years of age who for two years had suffered from a progressive bilateral drop in central vision. Examination of the fundi showed well-developed angioid streaks and macular exudates and hemorrhages. Dermatological examination showed a typical pseudoxanthoma of the skin of the neck. In spite of intensive systemic therapy, including vitamins A, K, and P, methionine, inositol, and placental inclusions, no improvement occurred. In discussing the syndrome the authors note its hereditary nature and its transmission as a recessive character. They note further that incomplete forms can occur, or the complete syndrome, with widespread cardiovascular involvement. They discuss the relationship of the disease to the so-called collagen diseases but defer any decision as to its inclusion in this group. (3 figures, 58 references)

Phillips Thygeson.

Fletcher, Mary C. **The developing fundus oculi of the premature infant and its relationship to retrolental fibroplasia.** J. Pediat. **43**:499-523, Nov., 1953.

Serial examinations were made of 320 small premature infants. About half of the infants with a birth weight less than 1,500 grams are born with an "immature fundus," which tends to remain unchanged for several weeks, then becomes differentiated ("transitional") in another one to two weeks to the appearance of the "mature" or full-term eye. From this point the eye may remain normal or develop retrolental fibroplasia. The immature fundus is seen through vitreous haze to have an indistinct oval disc, and small, sparse vessels seen at −10 to −20D. The transitional fundus shows rapid clearing of the vitreous, a greater number of small vessels, rounder disc, and grayish periphery. The mature fundus has clearer vitreous and adult blood vessel pattern. The development of retrolental fibroplasia from the mature fundus is described and classified on a modified Reese scheme.

There was a statistically significant increased incidence of retrolental fibroplasia in the white and male infants. Evidence is presented to show 1. that the smallest infants with the most immature fundi at birth are the ones most likely to develop severe retrolental fibroplasia and 2. that small premature babies, and those with severe retrolental fibroplasia have a high and fluctuating myopia which may remain as a residual lesion. (24 figures, 15 tables, 13 references) Robert A. Moses.

Lijó Pavía, J. **Atypical disposition of macular hemorrhages.** Rev. oto-neuro-oftal. Sud-am. **28**:122-125, Oct.-Nov., 1953.

The author reviews briefly the appearance of macular hemorrhages and presents the case history of a slightly myopic woman who for several years had yellowish spots in her macular area, combined with a posterior detachment of the vitreous. During this period, the entire macular area became atrophic. Coincident with acute gastric symptoms, due to an ulcer, she had a hemorrhage in the temporal half of the macula, which did not invade the nasal half, but progressed superiorly and in time became reabsorbed completely, leaving a large area of retinal atrophy. The fact that the nasal half of the macular area was not invaded, but that there existed a rather upward displacement of the hemorrhage, would indicate that the proliferating elements invaded the macular area from below, from the area which had not been affected by the hemorrhage. (2 figures, 10 references) Walter Mayer.

Lindner, K. **The surgical treatment of high myopia, coincidentally with that of retinal detachment.** Wien. klin. Wchnschr. **66**:8-10, Jan., 1954.

After sealing the retinal holes by electrocoagulation Lindner excises a scleral strip, 3 to 3½ mm. wide, completely around the globe in the region of the equator. A myopia may be reduced by 8 or 10 diopters. However, highly myopic patients need not be delighted to find themselves with a retinal detachment in the belief that the surgery for the detachment will also reduce their myopia. This is possible only under certain conditions and even then all of the operations are not successful. Reduction of the myopia unquestionably is a boon to the patient because highly myopic eyes almost always loose their central vision in time as a result of tractive stretching of the tissues. Although partial shortening of the globe is a generally accepted operation, Lindner believes that very few of his colleagues will risk this complete circular scleral shortening; compared to it every other ophthalmic operation is child's play. (3 figures, 1 reference) F. H. Haessler.

Mackensen, G. **Congenital retinal folds and persistence of vitreous vessels.** Klin. Monatsbl, f. Augenh. **123**:417-433, 1953.

A three and one-half-year-old girl is described who had microcephalus and in each eye a retinal fold and a grayish mass in the periphery of the fundus. Two boys, brothers 13 and 10 years old, are also presented. Each has a retinal fold in the right eye and pathologic vitreous opacities in the left. Finally, a 32-year-old woman with a persistent hyaloid artery in one eye is described. The author discusses the literature and speculates on the etiology of these changes. (6 figures, 27 references) Frederick C. Blodi.

Pajtas, J. **The treatment of tuberculous periphlebitis with electrocoagulation combined with streptomycin and para-aminosalicylic acid.** Ophthalmologica **126**:116-122, Aug., 1953.

This report (from Čekoslovakia) concerns a series of eight typical cases of periphlebitis retinae in young adults with strong evidence for a tuberculous etiology. The treatment consisted of streptomycin parenterally or subconjunctivally and large dose of PAS by mouth. For the relief of retinal detachments due to retinitis proliferans the author performed diathermy coagulations on all eight cases. In five of these cases the condition of the eye improved remarkably and lastingly. The author believes that the perforating electrocoagulations performed in his cases made conditions more favorable for absorption of the existing hemorrhages and prevented the occurrence of new hemorrhages. (9 references) Peter C. Kronfeld.

Paufique, L., and Moreau, P. G. **Lyophilic vitreous transplants: preliminary**

report. Ann. d'ocul. **186**:873-875, Oct., 1953.

To overcome the usual causes for failure of vitreous transplants, the authors have experimented with the use of lyophilic vitreous. This is vitreous which, having been completely dehydrated under vacuum at 12 degrees below zero, has been changed into a white powder, considerably diminished in volume, but not essentially changed in chemical properties. Rehydration of the powder results in a perfectly transparent vitreous with a viscosity identical to that of the original sample, and microscopically indistinguishable from it. A special trocar has been devised for injection purposes. Successful transplants have been carried out on rabbits. In man, the method has so far only been used in hopeless cases, so that the authors are not yet in a position to report on results in terms of visual acuity. However, they hold out great hopes for the ultimate value of this new technique.

John C. Locke.

Piper, H. F., and Wagner, G. **Eye ground changes in cases of tuberculosis of the skin.** Ophthalmologica **125**:447-458, June 1953.

A large series of cases of tuberculosis of the skin was surveyed. Nearly all the eyes showed fine pigment irregularities in the fundus which were interpreted as signs of a systemic exhaustive disease. Two cases of cervical glandular disease and one case of lupus vulgaris showed gross ocular pathology, in the form of circinate retinopathy or of periphlebitis. (3 figures, 16 references)

Peter C. Kronfeld.

Redslob, E. **Problems concerning the retinal circulation.** Ann. d'ocul. **186**:585-595, July, 1953.

This study is mainly concerned with the terminal characteristics of the retinal arterioles. In a cardiac patient affected with vascular sclerosis, a reversed (centripetal) granular current occurred in the superior nasal retinal arteriole, during the course of a dynamometric examination. The author believes that the blood must have entered this arteriole from a neighboring arteriole by means of fine interarteriolar communications, not visible with the ophthalmoscope. He postulates a system of capillaries of special nature, capillaries of alarm, which function when the circulation suffers locally.

John C. Locke.

De Rosa, L., and De Vincentiis, M. **Nitrogen in the vitreous in experimental pigmentary degeneration of the retina.** Rassegna ital. d'otal. **22**:481-484, Sept.-Oct., 1953.

The purpose of the experiment described was to attempt to explain the changes seen in the vitreous in cases of pigmentary degeneration of the retina in man. The changes found were a reduction of the retrolental space, liquefaction of the framework of the vitreous and various opacities of varying colors. These add up to an accumulation of protein nitrogen. The picture of retinitis pigmentosa was produced by intravenous injection of sodium iodide in rabbits. It is suggested that possibly such an abnormal accumulation of nitrogen may be a factor in the secondary involvement of the lens in this disease in man. (8 references)

Eugene M. Blake.

Rossi, Antonio. **Therapeutic effect of ACTH in retinitis pigmentosa.** Rassegna ital. d'otal. **22**:491-499, Sept.-Oct., 1953.

Seven cases of pigmentary degeneration of the retina were treated, employing various preparations of ACTH. The dosage was 18 to 24 mg. per day divided into two or three intramuscular injections for a dosage of 300 to 400 mg. This program was repeated after 20 to 40 days until 1200

to 1500 mg. were given. At the same time heavy doses of ascorbic acid were added. There were no side effects necessitating an interruption of treatment. Observations were made of visual acuity, light sense, and visual fields. No definite improvement was obtained; some patients apparently benefited slightly, but whether this was actual or psychological was uncertain. The author suggests that treatment administered early in the course of the disease might be more effective. (7 references) Eugene M. Blake.

Sauer, H., and Koch, H. **Proliferative diabetic retinopathy in Kimmelstiel-Wilson's disease.** Klin. Monatsbl. f. Augenh. **123**:395-404, 1953.

The authors found, following Waite and Beetham, a close correlation between Kimmelstiel-Wilson's disease and proliferative diabetic retinopathy. Among 32 patients with the proliferative type of diabetic retinopathy 25 had albuminuria, which served here as the criterion for the diagnosis of the typical kidney lesion. The percentage was much higher than among patients with the ordinary diabetic retinopathy, though the duration of the disease and the age of the patients did not differ significantly in the two series. Fundi with venectasia with or without newformed capillaries are here grouped with the proliferative retinopathies. (3 figures, 3 charts, 45 references) Frederick C. Blodi.

Sheehan, B. **Congenital vascular veils in the vitreous.** Tr. Ophth. Soc. U. Kingdom **72**:623-628, 1952.

Two patients, an uncle and nephew, were presented with similar findings of extensive veil-like membranes coming forward from the retina. There was a mottled dystrophy of the macula in the uncle; the child's macular areas appeared normal. The author felt that these could be called congenital vascular veils in the vitreous as described by Mann and Macrae in 1938. (4 figures) Beulah Cushman.

Simonelli, M., and Faldi, S. **Better view of retinal tears after intravenous injection of fluorescin and Geigy blue.** Giorn. ital. oftal. **4**:322-329, July-Aug., 1953.

The authors have used the method, suggested by Offret and Decaudin (intravenous injection of 2 cc. sodium fluorescin in 10-percent solution) on 50 cases of retinal detachment and compared the visibility of tears before and after the injection. In more than one-half of the cases there was better visibility of tears after the injection while in 20 cases in which the retina had become replaced after rest in bed there was no appreciable difference. In 12 cases in which intravenous injection of a ½-percent solution of Geigy blue was used, the results were very similar to those obtained after fluorescin injection. The better visibility was the result of greater contrast of the margins of the hole (which assumed a pale green color) and the base of the tear. The possible mechanisms for this increased contrast are discussed and the view is expressed that great weight should be attached to the staining of the subretinal fluid by the drugs injected. V. Tabone.

Symons, H. M. **Case notes: early retinal detachment.** Brit. J. Ophth. **37**:376-377, June, 1953.

A patient with a localized retinal lesion, probably pre-detachment, was seen and treated successfully with diathermy. (2 figures, 1 reference) Orwyn H. Ellis.

12

OPTIC NERVE AND CHIASM

Danis, P., and Bastenie, P. **The optic nerve lesions associated with endocrine exophthalmos.** Ophthalmologica **126**:65-90, Aug., 1953.

The report concerns a case of bilateral retrobulbar neuritis which developed in a 58-year-old patient with hyperthyroidism and typical edematous orbital disease during a period of treatment with propyl thiouracil. The patient was followed for a period of approximately two years. Only conservative treatment was used and the outcome was favorable. The authors stress the lack of parallelism between general and orbital manifestations of the disease. In order to decide what form of treatment offers the best chance in such cases the authors ask that similar cases be followed closely, with special attention to quantitative relationships between orbital and general symptoms, and that these cases be reported in detail. (6 figures, 39 references) Peter C. Kronfeld.

Morgan, O. Gayer. **Methylated spirit addiction.** Tr. Ophth. Soc. U. Kingdom **72**:435-441, 1952.

The author presents methyl-alcohol poisoning in cases of central scotoma and optic atrophy which are becoming more common. The effect of methyl alcohol varies in individuals; its oxidation may be affected by exercise, fluid intake and conditions of acidosis. Early recognition is important for successful treatment which should include rapid correction of acidosis by use of bicarbonates intravenously and by mouth; or glucose intravenously, fluid to combat dehydration, ethyl-alcohol as an emergency measure, protection against light, and complete rest.
Beulah Cushman.

Planten, J. T. **Toxic amblyopia caused by ethylpyridine.** Nederl. tijdschr. v. geneesk. **97**:540-542, Feb., 1953.

An amblyopia is described which was probably due to ethylpyridine, an intermediary product in the manufacture of isonicotinic acid hydrazide.
G. H. Jonkers.

Trueman, R. H., and Rubin I. E. **Tumor of the optic disc associated with neurofibromatosis.** A.M.A. Arch. Ophth. **50**: 468-474, Oct., 1953.

This is the third report in the literature of the occurrence of a tumor of the optic nerve associated with neurofibromatosis (von Recklinghausen's disease). In this case the tumor appeared as an elevated doughnut-shaped ring filled with a nodular, gray striated mass. It completely occupied the optic disc and was surrounded by a halo of choroidal sclerosis. In this case as in the two previously reported ones the visual acuity was not greatly affected. (1 figure, 14 references)
G. S. Tyner.

Vannini, A. **Bilateral retrobulbar neuritis following unilateral ophthalmic herpes zoster.** Rassegna ital. d'ottal. **22**: 401-405, July-Aug., 1953.

A 48-year-old man developed herpes zoster about the left eye and was given 250,000 units of penicillin intramuscularly and 200 mg. aureomycin daily. Recovery from the herpes occurred in 15 days but 45 days later vision decreased in the left eye and shortly afterwards in the right. Various explanations are offered as to the possible route by which the virus could travel to affect the optic nerves. (7 references) Eugene M. Blake.

13

NEURO-OPHTHALMOLOGY

Bruna, F. **Treatment of hypophyseal adenomas with androgen steroids.** Boll. d'ocul. **32**:657-680, Nov., 1953.

Histories of three patients with hypophyseal adenomas show the beneficial influence of high doses of testosterone on the visual field defects, the phosphatemia, and the headache. Two of the patients had acromegaly, the third probably a chromophobe benign adenoma. In the last case the visual field defect showed com-

plete regression. (8 figures, 50 references) K. W. Ascher.

Cantullera, Arriaga. **The importance of exploration of color fields.** Arch. Soc. oftal. hispano-am. **13**:1054-1063, Sept., 1953.

The author points to the importance of exploration of the color fields in cases of visual disturbance, and reports three cases to support his contention. In the first case, with pallor of the temporal portions of the optic disc and reduced visual acuity, the fields for white were normal, but exploration of the color fields revealed inversion of the fields for red and green, central and paracentral scotoma for green, and a superior temporal quadrant anopsia for red. In the second case of tobacco amblyopia in the left eye, the visual field for white in the right eye was normal, but there was a cecocentral scotoma for red. In the third case a diagnosis of toxic retrobulbar neuritis was made on a defect in the field for red, when the field for white and blue was normal. (6 figures) Ray K. Daily.

Cavka, V. **Neuro-ophthalmologic symptoms in prefrontal lobotomy.** Arch. d'opht. **13**:465-471, 1953.

In 5 cases of transorbital lobotomy, first of the right side, then of the left, Cavka noted anisocoria with dilated pupil on the right which in two cases passed to the left pupil after several days. In 5 other cases in which the operation was unilateral (4 right side, 1 left side), the anisocoria of the pupils showed in 3 cases dilatation of the pupil on the operated side, and in 2 cases a dilatation of the pupil on the opposite side. In 3 cases there was a conjugate deviation; in two of these the deviation was contralateral and in one it was homolateral. In 2 cases a divergence of from 10 to 15 degrees developed. In 4 of the 10 cases a passive congestion of the papilla was noted; exceptionally the additional symptoms of hypertropia, esotropia, horizontal and rotatory nystagmus were noted. No effect on the intraocular pressure was observed. (6 references) Phillips Thygeson.

Czukrász, I. **Naso-pharyngeal fibroma giving rise to severe ocular symptoms.** Szemészet **3**:110-113, 1953.

Two cases of basal fibroid are reported. In both bilateral exophthalmus occurred. The protrusion of the bulbi was particularly enormous in one of them. In the other the examination of the visual field, fundus, and the sella, induced the author to assume the presence of a pituitary tumor; however, the patient died before the operation. The necropsy revealed that the tumor started from the pharynx and extended to the cranial base into the orbits, and into the lateral ventricle. Death was due to pneumonia; paralysis of the cranial nerves interfered with the mechanism of swallowing. The author points out that the naso-pharyngeal cavity should invariably be examined in exophthalmus in order to obtain a diagnosis.

Gyula Lugossy.

François, J., and Verriest, G. **Pituitary tumor with atypical field changes.** Ann. d'ocul. **186**:1001-1012, Nov., 1953.

The authors report a case of intrasellar cystic tumor in which the earliest field change was a total right homonymous hemianopsia, which only later evolved towards a more typical bitemporal hemianopsia. They explain this sequence on the basis of a reactionary edema of the left optic tract. (14 figures) John C. Locke.

Freusberg, O., and Moellmann, D. **Ophthalmodynamometry in cases of brain tumors.** Rev. brasil. oftal. **12**:275-280, Dec., 1953.

The author discusses briefly the methods of ophthalmodynamometry advocated by Baillard, Streiff, and Baurmann, and

emphasizes the difficulties in comparing their respective results. By following the classic methods of ophthalmodynamometry, vascular disturbances can be demonstrated in only 28 to 44 percent of patients with cerebral tumors. For his studies the author uses the "medium retinal pressure," which is the sum of the diastolic pressure and 42 percent of the difference between diastolic and systolic pressures. By using this method, he is able to determine vascular disturbances in 44 to 56 percent of cases with brain tumors. The author emphasizes the necessity of studying both eyes, because of the frequent finding of unequal ophthalmodynamometric readings. The last part of his paper is devoted to the physiology of the pressure in the central retinal artery; he explains clearly, with examples, how in some cases one may find hypotension, in others, hypertension, and finally in others a systolic hypotension combined with a diastolic hypertension. (2 tables)

Walter Mayer.

Haarr, M. **Periphlebitis retinae in association with multiple sclerosis.** Acta Psychiat. & Neural. Scandinev. **28**:175-190, 1953.

Periphlebitis retinae was found in 22.8 percent of 303 cases of multiple sclerosis. Active periphlebitis retinae is seen before the age of 40 years and in the first ten years of the disease. If medication is used in the treatment of multiple sclerosis, it should also influence the active periphlebitis retinae and therefore serve as an indicator of the progress. (3 figures, 40 references)

Irwin E. Gaynon.

Klein, R., and Stack, J. J. **Visual agnosia and alternating dominance; analysis of a case.** J. Ment. Sc. **99**:749-762, Oct., 1953.

A 32-year-old engineer who had lost the sight of his right eye in infancy and was right handed, attempted suicide by slashing the right side of his neck. Pressure on the neck caused a venous thrombus in the right occipital lobe. He had a temporal field defect of the left eye, temporary visual agnosia, cortical color blindness, color agnosia, but no word blindness. (2 figures, 14 references)

Irwin E. Gaynon.

Kluyskens, J., and Titeca, J. **Electroencephalographic examination of the visual field.** Ophthalmologica **126**:129-148, Sept., 1953.

The authors have worked out an electroencephalographic, that is objective, method of determining the limits of the visual field as well as the borders of scotomas within the visual field. The basis of their test is the inhibition (arrest) of the characteristic alpha waves of the normal electroencephalogram caused by exposure of one eye to a light stimulus. The results obtained with this objective method checked well with those obtained by the ordinary subjective method of perimetry. Such good agreement was found in normal individuals as well as in individuals with organic lesions of the visual pathway. Gross discrepancies between the results obtained by the two methods were noted in malingerers and in patients with functional diseases. (14 figures, 4 references)

Peter C. Kronfeld.

Laje Weskamp, Rodolfo. **Ophthalmology in its relations and contributions to neurology.** Rev. oto-neuro-oftal. Sud-am. **28**:107-117, Oct.-Nov., 1953.

The author emphasizes the necessity of keeping abreast with all the innovations in medicine and warns about the danger of too much specialization. He then reviews briefly the excellent diagnostic equipment which has been made available to ophthalmologists during the past 100 years. He calls attention to the important role which the ophthalmologist plays in the early diagnosis of brain tumors, and states that

ophthalmoscopy, perimetry, ophthalmodynamometry, study of pupillary reactions, study of extraocular muscles, radiographic studies of the orbit, and biomicroscopy of the fundus should all be used to help in the early diagnosis. He also emphasizes the localizing importance of the lesions of the extraocular muscles.

Walter Mayer.

Leoz de la Fuente, G. **Binasal hemianopsia.** Arch. Soc. oftal. hispano-am. **13**: 1036-1045, Sept., 1953.

A woman, 33 years old, developed a binasal hemianopsia, diplopia, reduced central visual acuity, slight exophthalmos of the right eye, and choked disc in the left eye after recovery from an attack of acute meningitis. A thorough neurologic study revealed the presence of cranial pharyngioma. At the operation a large cystic tumor which contained 30 cc. of pus and blood emerged from the pituitary fossa, pushing the chiasm 15 mm. backwards; the stretched optic nerves were compressed laterally by the carotid arteries. The patient recovered after surgery. The interesting feature of this case is the effect of the acute infection on a neoplasm which must have been there long before the acute attack of meningitis, and which originated from a congenital remnant. The acute infection apparently stimulated the tumor to rapid growth. (5 figures)

Ray K. Daily.

Moacyr de Aguiar, Pedro. **Papilledema.** Rev. brasil. oftal. **12**:281-286, Dec., 1953.

In this statistical study of 114 patients with papilledema the author also describes the other ocular disturbances which these patients presented. In 88 an etiologic diagnosis of the papilledema could be made; 42 cases were due to proven cerebral tumors, 10 probably to neoplastic tumors, 10 to non-neoplastic tumors such as subdural hematoma and tuberculoma, and 26 were not the result of space-taking lesions. (7 references)

Walter Mayer.

Monnier, M., and von Berger, G. P. **The electric response of the human cortical visual centers to physiologic retinal stimulation.** Ophthalmologica **126**:15-34, July, 1953.

This is an electroencephalographic or electrocorticographic study of the area striata in man under the influence of physiologic light stimuli acting upon one or both eyes. Through multiple electrodes placed against the scalp over the occipital region, consistent specific electric responses to stimulation of one or both eyes with flashes of light could be obtained. By means of electrodes placed over other areas of the skull, disturbing factors, such as the effect of ocular movements, could be reduced to a minimum. Simultaneous recording of the electroretinogram permitted the determination of the retinocortical interval which is probably related to the conduction time of the visual pathway. The characteristic response of the visual cortex was a positive potential similar to the b-wave of the electroretinogram and, therefore, named the b-potential. Its culmination came about 35 milliseconds after the culmination of the flash. The b-potential was followed by c, d, and e components which were, probably, very much influenced if not mostly made up by the alpha-waves of the cortex. All measurements were easier and more consistent in children than in adults, probably because of the thinner skull. The determination of the retinocortical interval may prove of practical value for the localization of cerebral lesions. (8 figures, 14 references)

Peter C. Kronfeld.

Reymond, A., Weber, G., Huber, A., and Rintelen, F. **Symposium on intracranial tumors.** Ophthalmologica **125**:204-340, April-May, 1953.

Reymond, A. **Pathologic classification of cerebral tumors.** pp. 204-230.

A general pathologist presents the pathologic characteristics of the typical and commoner entities among the intracranial tumors. This part of the symposium is in clear, concise French and accompanied by almost equally clear, black and white photographs of gross anatomical specimens. Much credit is given to Cushing and Bailey whose "work still remains the basis of all useful classifications of the gliomas." (18 figures, 19 references)

Weber, G. **An introduction to the diagnosis and prognosis of intracranial tumors.** pp. 231-286.

This section, written in German by a neurosurgeon, deals first with the general symptomatology of intracranial tumors. Steady progressiveness of symptoms pointing toward a localized area of the brain is the cardinal sign of an intracranial tumor and usually precedes the signs of increased intracranial pressure. The latter may be due to the volume of the tumor itself, to cerebral edema caused by the tumor or to interference with the normal circulation of spinal fluid. Very extensive space-occupying processes lead to tissue displacements with typical symptomatologies, the herniation of cerebral (usually temporal lobe) tissue into the incisura of the tentorium and the incarceration of the cerebellar tonsils in the foramen magnum.

Lesions of the following regions cause fairly characteristic combinations of symptoms, that is syndromes: the chiasma, the cavernous sinus, the anterior and posterior central gyrus, the uncinate gyrus, the occipital lobe, the pineal region (causing Parinaud's syndrome), the cerebellar hemispheres and the vermis cerebelli, the cerebellopontine angle, the pedunculi, the pons and the medulla oblongata.

Of the newer diagnostic means electroencephalography has proved to be of value for the very rough localization of the tumor. The value of angiography lies in that it reveals displacement of normal vessels and, occasionally, allows visualization of tumor vessels. Arteriography of the vertebral artery yields, in general, very much less information than arteriography of the carotid artery. Ventriculography is indicated if the clinical symptoms and other diagnostic methods point toward a tumor of the brain stem or of the posterior fossa. Spinal puncture rarely yields pertinent information in intracranial tumors and is strictly contraindicated if signs of increased intracranial pressure are present.

Angiography and ventriculography are by no means free of danger. It would be of great value to neurosurgeons if a perfectly harmless contrast agent for angiography could be found. The author has had no experience with radioactive diiodine-fluorescein or with ultrasonic waves.

The next chapter deals with the clinical symptoms and the course of the disease in the typical entities of intracranial tumors. Of particular interest to the reader will be the chapter concerning the end results in 1,264 cases of intracranial tumor treated in the department of neurosurgery of the University of Zurich. The follow-up seems to have been particularly thorough in this series. The results permit definite conclusions concerning the prognosis in the various entities of brain tumors, with particular reference to the patient's chances of returning to a normal or fairly normal life. (14 figures, 23 tables, 45 references)

Huber, A. **The ophthalmologic symptomatology of supratentorial brain tumors.** pp. 287-319.

This section of the symposium is based upon a review of 250 cases of intracranial tumors. The differential diagnosis of choked disc is discussed in detail. The

finding of retinal venous pulsation at the normal or slightly raised ocular tension level does not rule out the presence of increased intracranial pressure. Mild signs of a 3-diopter nerve palsy may be due to impingement upon the nerve at or near the incisura tentorii. The typical Foster-Kennedy syndrome occurred only once in this series of 250 cases. The typical result of occipital lobectomies is homonymous hemianopsia without sparing of the macula. Tumors of a chiefly temporal location differ from tumors with a more parieto-occipital location by less complete visual field defects and more complex visual hallucinations. (21 figures, 23 references)

Rintelen, F. **The ophthalmoneurologic symptoms and syndromes due to infratentorial brain tumors.** pp. 320-340.

The author reviews the anatomy of the tentorium and the physiology of the cerebellum. Considerable progress has been made with regard to cerebellar tumors because of the relatively frequent occurrence of well-operable types of tumors, such as hemangiomas, astrocytomas and acoustic neuromas.

By interfering relatively early with the circulation of the spinal fluid, cerebellar tumors tend to cause increased intracranial pressure and a number of distant effects, that is hypothalamic or chiasmal lesions including erosion of the clinoid processes.

A series of eight tumors of the cerebellopontine angle are reported of which five proved to be acoustic neuromas. The ophthalmologist may be in a position to contribute to the early recognition of these tumors by detecting a very slight degree of anesthesia of the cornea or of facial nerve palsy. Choking of the disc is usually a late development in these cases. Variability of the symptoms may be more characteristic than the steady progression expected of brain tumors. (5 figures, 3 tables, 21 references) Peter C. Kronfeld.

Surbirana, A., and Puncernau, R. **Ophthalmoneurologic symptomatology and angiography in spontaneous meningeal hemorrhages.** Arch. Soc. oftal. hispanoam. **13**:991-1035, Sept., 1953.

The original contribution in this comprehensive review of the subject, accompanied by an extensive bibliography, is a detailed report of six cases, including ophthalmoneurologic, encephalographic and angiographic data. The authors point out that the majority of intracranial hemorrhages, diagnosed erroneously as idiopathic, are caused by the rupture of an intracranial aneurysm situated at the points of bifurcation of the circle of Willis. The author also calls attention to the relative frequency of arteriovenous angiomas. (10 figures, 161 references)

Ray K. Daily.

14

EYEBALL, ORBIT, SINUSES

Fazakas, Alexander. **The repair of contracted sockets after war injuries.** Ophthalmologica **126**:157-161, Sept., 1953.

The procedure described herein aims specifically at the formation and maintenance of a deep lower fornix, after symblepharon operations in the presence of the eyeball or after plastic repair of a contracted socket. The principle of the method, in the case of complete lower symblepharon with the lid border adherent to the bulbar conjunctiva just below the limbus, is this: the scar tissue binding lid and eyeball together is converted by two parallel frontal incisions, into a flap adherent only at the site of the future lower fornix. By deeper dissection behind this flap a bed is made for it close to the orbital floor. The flap is now turned down so that its upper edge, formerly located at

the lid border, now becomes its lowermost portion. In that position the flap is sutured to the adjacent structures. This turned-down scar tissue flap becomes the foundation of the new fornix. The grafts necessary to cover the raw lid and globe surfaces are sutured to this foundation. In one such case the operation worked very well.

Fazakas now describes several cases of obliteration of the lower fornix after war injuries with loss of the globe. Operations similar to the one described above resulted in good, permanent lower fornices. (4 figures)

Gebertt, S. **A simple movable eye implant.** Tr. Ophth. Soc. U. Kingdom **72**: 585-603, 1952.

The author reported on the use of a pear-shaped methyl-metha-crylate mold with loops of 18 carat gold of vitallium which had been used as an implant within the sclera for two years. Its use was shown in a movie. The implant can be released if necessary by opening the old wound and cutting the wires. (3 figures)

Beulah Cushman.

Oesterle, Gabriella. **The problem of a socket formation after enucleation.** Klin. Monatsbl. f. Augenh. **123**:477-489, 1953.

The author advises a Perlon implant. Perlon is a synthetic, plastic bag filled with a plastic wool of the same material. The implant is light and pliable. It is inserted into Tenon's capsule and the rectus muscles are sutured over it. Of 91 implants, 16 were extruded. (16 figures, 3 charts, 10 references).

Frederick C. Blodi.

Poos, Fr. **The orbital signs in Graves' disease and their pathogenesis.** Arch. f. Ophth. **154**:18-41, 1953.

The author offers a number of theoretical considerations in order to find a common pathogenetic factor for the various orbital phenomena involved in Graves' disease. He feels that this factor is presented by the orbital circulatory disturbance due to venous congestion. The orbital blockage is said to be caused by periodic swelling of the thyroid gland and high tachycardic pulse waves. This causes edematous changes of the tissues and especially affects the external rectus muscles. The exophthalmus is also said to result from these circulatory disturbances. (26 references) Ernst Schmerl.

15

EYELIDS, LACRIMAL APPARATUS

Alberth, B. **Successful dacryocystorhinostomy in a case of tuberculous dacryocystitis.** Ophthalmologica **126**:168-171, Sept., 1953.

In general, dacryocystorhinostomy is considered contraindicated in cases of tuberculous dacryocystitis. In the case under discussion, a 17-year-old girl, the diagnosis of tuberculous dacryocystitis was based upon the following findings: a previous tuberculous lesion of the mucous membrane of the nose, epithelioid nodules and giant cells in the chronically inflamed wall of the lacrimal sac, acid-fast bacilli in its contents and in the washings from the lacrimal passages after dacryocystorhinostomy. The operation itself was uncomplicated. The postoperative treatment consisted of streptomycin systemically and topically (instillation and irrigation) and of PAS orally. Under this treatment the skin incision healed promptly and the epiphora ceased. The result was still good one year after the operation. (2 figures, 9 references) Peter C. Kronfeld.

Beam, A. Duane. **Intubation of nasolacrimal duct for epiphora caused by stricture of nasolacrimal duct.** Kresge Eye Inst. Bull. **4**:63-68, Feb., 1953.

The author describes a nonoperative method of intubation for strictures of the nasolacrymal duct which in some instances makes dacryocystorhinostomy unnecessary. Bowman's probes of increasing size are inserted through the upper canaliculus and sac and into the inferior fossa of the nasal cavity until a number 5 or 6 probe can be introduced. With the probe in place, the distance is measured between the level of the internal canthal ligament and the edge of the little plate, called the finger grip, in the middle of the probe. A section of polyethylene tubing with a lumen which will just admit the probe, is cut exactly one millimeter shorter than the length of the probe, usually about 57 mm. This section is then divided at the measured point on the probe indicating the in situ level of the canthal ligament. The two pieces are then threaded on the probe, the "upper" section being threaded on first. The section supports the thrust necessary to insert the lower portion into the nasolacrimal duct. The probe, with both pieces of tubing, is then passed into the nasolacrimal duct. It is always necessary to inspect the nasal passages to be certain that the probe extends into it. A nasal pharyngoscope or a self-illuminating speculum is useful in locating the probe as it enters through the lacrimal ostium. The probe and upper section of tubing are withdrawn, leaving the distal end of the tubing in the duct. Any tendency of the distal section of tubing to be withdrawn may be overcome by the use of an alligator type Noyes ear forceps with serrated jaws to hold the tubing in the nose while the probe is withdrawn. Four excellent drawings are used to explain the technique. Alston Callahan.

Farina, R., and de Toledo Piza, P. **Surgical correction of ectropion.** Rev. brasil. oftal. **12**:257, Dec., 1953.

The authors emphasize the baneful effects of ectropion. They advise a blepharoplasty with use of a graft from the mastoid or antebrachial area. They consider a tarsorraphy absolutely necessary.

Walter Mayer.

Nover, A., and Mueller, W. **The lacrimal gland of man and the lymphoglandular system.** Arch. f. Ophth. **154**:42-49, 1953.

Lacrimal glands of adults and infants were histochemically studied. The Hotchkiss-McManus reaction was used to demonstrate the presence of mucopolysaccharides. In adults these substances were found in the distal ends of the glands, in infants in the epithelial cells of the ducts and within the ducts themselves. Lymphocytes were absent in young infants, present in adults. A correlation between the larger amount of mucopolysaccharides and the lack of lymphocytes in infants is considered by the authors. In early infancy the saccharides seem to exercise a local protection of the gland, while the lymphocytes probably act as defense mechanism in the adults. (5 figures, 22 references) Ernst Schmerl.

Piper, Hans-Felix. **Ptosis, a functional exhaustion of the eye.** Klin. Monatsbl. f. Augenh. **123**:702-710, 1953.

The author theorizes on the importance of ptosis as a manifestation of inadequate performance of the eye. (5 figures, 8 references) Frederick C. Blodi.

Polychronakos, D. J. **Free skin grafts in the treatment of cicatricial ectropion.** Arch. d'opht. **13**:486-494, 1953.

The author reviews the literature on the treatment of cicatricial ectropion, with particular reference to the use of free skin grafts, and reports his observations on 10 of his own patients. He concludes that free skin grafts have decided advantages

over other methods of blepharoplasty. He warns that blepharorrhaphy is always necessary and must be maintained over an extended period of time to avoid retraction or folding of the graft, and that the graft must not be too small. He notes that the difference in color of the graft eventually disappears. (5 figures, 24 references)

Phillips Thygeson.

Sobandski, Janusz. **Treatment of the lacrimal sac in infants.** Klinika Oczna **23**: 133-136, 1953.

The author describes the normal steps in the development of the lacrimal passages and the process of development of obstruction in the passages in infants. He suggests that pressure over the lacrimal sac be applied immediately after birth, after the face of the newborn is cleaned, before instillation of silver nitrate. This procedure ruptures the thin membrane which may be present at the end of the naso-lacrimal canal. When obstruction causes dacryocystitis the usual conservative treatment is necessary. Probing is done when inflammatory symptoms subside. When these steps are insufficient a dacryocystorhinostomy should be done. However, one should wait until the child is at least one year old.

Sylvan Brandon.

16

TUMORS

Bonavolonta, G. **A rare case of bilateral epibulbar tumors.** Arch. di ottal. **57**:395-404, Sept.-Oct., 1953.

An epibulbar spinocellular epithelioma originating in the perilimbic bulbar conjunctiva with corneal involvement is reported. The other eye showed a hyperplastic process with dysplastic tendencies in the limbal conjunctiva. Histological studies indicate that the simple hyperplastic process is a pre-neoplastic phase of the tumor in the other eye. (9 figures, 6 references)

John J. Stern.

Greer, C. H. **Epithelial tumors of the retinal pigment epithelium.** Tr. Ophth. Soc. U. Kingdom **72**:265-276, 1952.

The author reviewed the literature on true neoplasms of the pigment epithelium of the retina, which are exceedingly rare, and presented a further case. Only five cases were found in the literature of the last 58 years and of these three are inadmissible. Greer discusses the relationship between inflammatory hyperplasias and neoplasms and presents evidence for placing the tumor which he describes among the true neoplasms of the retinal pigment epithelium. (6 figures, 10 references)

Beulah Cushman.

Gualdi, Giovanni. **A rare orbital neoplasm.** Rassegna ital. d'ottal. **22**:472-480, Sept.-Oct., 1953.

The patient was a man of 63 years, in good health, and with an uneventful past history except for an injury to the left eye four months before the discovery of a mass on the left orbital margin below. The swelling measured 4 × 1 cm., was slightly elastic and non-motile. Esotropia was noted. Histologic study showed the tumor to be a lymphoma, and more precisely a lymphocytic lymphoma of Gall and Mallory, or a lymphocytopoietic lymphoma in the terminology of Gillman. (3 figures, 13 references)

Eugene M. Blake.

Nover, A. **Malignant orbital tumors.** Ophthalmologica **126**:35-44, July, 1953.

Two cases of orbital perithelioma and two of orbital retothelioma, that is reticulo-endothelial sarcoma, are reported. The former type of tumor occurred in adult patients and consisted, histologically, of tall cylindrical cells forming thick mantles around preexisting or new-formed blood vessels. The origin of the tumor

cells from the perithelium of orbital vessels was highly probable. The tumors grew by invading adjacent structures as well as by metastases. The retrotheliomas occurred in a two-year-old boy and in a 17-year-old boy. Large round cells, syncytially connected with each other and imbedded in a well-developed argentophilic fiber network made up these, again, very malignant tumors. (2 figures, 46 references) Peter C. Kronfeld.

Rama, G. **Pigmented tumor arising from the fossa for the lacrimal gland.** Ophthalmologica **126**:44-51, July, 1953.

A slow-growing pigmented tumor of the region of the lacrimal gland in a 75-year-old woman proved, histologically, to be well encapsulated and to consist partly of normal gland tissue and partly of a melanoma with mild signs of malignancy. The author classifies the tumor as melanoma sarcomatodes. (5 figures, 30 references) Peter C. Kronfeld.

Schulz, M. D., and Stetson, C. G. **Radiation therapy of malignant lesions about the eye.** Radiology **61**:786-795, Nov. 1953.

The malignant tumors occurring in and about the eye are classified and discussed individually as to success of treatment by irradiation. Details of technique are given. It is stated that retinoblastoma is said to be quite radiosensitive, and should be radiocurable. The authors' experience has been most dismal; no cures by external irradiation have been accomplished.

Lid carcinomas are classified I to IV according to stage of invasion; 80 percent of 156 early (class I and II) lesions were controlled by one course of irradiation, another 10 percent by further irradiation. Basal cell carcinomas constitute about 85 percent of lid carcinomas and are more radiosensitive than squamous cell carcinomas. Lymphomas are locally well controlled by irradiation. Metastatic neuroblastoma of the orbit and primary carcinoma of the lacrimal gland are well palliated by radiotherapy. Most other tumors are left to the surgeon. (4 tables.) Robert A. Moses.

17
INJURIES

Lepri, G. **Traumatic perforation of the macula; contribution to the pathogenesis of paramacular holes.** Arch. di ottal. **57**: 309-334, Sept.-Oct., 1953.

Traumatic holes in the macula and paramacular area respectively in two patients are described. Contrecoupe injury is assumed to play a role in the pathogenesis of this condition. (4 figures, 88 references) John J. Stern.

Rinaldi, G. **Benzyl-imidazoline chloryl-hydrate (Lambral) in the treatment of ocular burns.** Giorn. ital. oftal. **4**:335-342, July-Aug., 1953.

After reviewing the changes occurring in ocular tissues in burns as well as the various forms of treatment employed, the fact is emphasized that local spasm of the vessels plays a significant part in the destruction. By using the vasodilator "Lambral," it was intended to prevent the angiospasm and to prepare the ground for the formation of new vessels. In 62 cases, treated with success, no symblepharon was noticed. In mild cases 10 percent Lambral drops were instilled every two to four hours, and cure was obtained within five to eight days in moderate burns. Subconjunctival injections of 1-percent Lambral were given for one to two days in addition to instillation and cure was obtained in an average of 10.2 days. In severe cases daily injections of Lambral were necessary for an average of eight days. Cure was obtained in an average of 18.5 days. It is stressed that this type of treatment should be instituted as early as possible. V. Tabone.

Schirmer, R. **Chronic poisoning with nitrocellulose lacquers.** Klin. Monatsbl. f. Augenh. **123**:449-454, 1953.

Six men showed signs of chronic nitrocellulose poisoning; all were painters who used poisonous dyes and lacquers. One of them had a unilateral retrobulbar neuritis. (2 figures, 1 chart, 3 references)

Frederick C. Blodi.

Wilczek, Marian. **Trauma of the eye in children and adults.** Klinika Oczna **23**: 113-119, 1953.

From 1933 to 1938, 2,072 cases of trauma were seen in the Eye Clinic in Krakow. They occurred in 8.96 percent of all the patients; 71 percent in men, 12 percent in women, 11.5 percent in boys, and 5.5 percent in girls. Among hospitalized patients 50 percent of injuries in adults and 69 percent in children resulted in blindness. Sight was saved in one half of the patients in whom an intraocular foreign body was removed with a magnet. Measures for preventing injuries in industry are suggested. Those occurring in farming are much harder to prevent. To decrease the number of accidents among children the parents should be instructed in proper prevention. (8 references)

Sylvan Brandon.

18

SYSTEMIC DISEASE AND PARASITES

Adams, Dorothy. **Ophthalmic stress. (Doyne Memorial Lecture)** Tr. Ophth. Soc. U. Kingdom **72**:457-496, 1952.

The author discusses migraine, glaucoma, miners' nystagmus, thyrotoxic exophthalmos, progressive (thyrotropic) exophthalmos and myasthenia gravis which are diseases of ophthalmic stress and also in the category of psychosomatic medicine.

The physiological change in stress is a primary response to emotion or alarm as an overactivity of the adrenal glands, wherein the medulla is activated and pours out adrenalin which in turn stimulates the autonomic nervous system and produces physical signs of sweating, increased pulse, pallor, tremor, palpitations and enhanced emotions and the patient is unable to maintain the equanimity of the normal individual. The body is constantly adapting itself to the receipt of repeated small irritant or noxious stimuli many of which are disregarded by the conscious mind, but to which the body may succumb if the stimulus is too frequent or too persistent or the physical resources are depleted by ill health.

Stress is described in terms of endocrinology, and the ophthalmic diseases of stress and their response to local and systemic therapy are described.

Beulah Cushman.

Duke-Elder, S., Ashton, N., and Brihaye-Van Geertruyden, M. **Toxoplasmosis in the adult.** Brit. J. Ophth. **37**:321-328, June, 1953.

The literature is reviewed and the authors present a case in an adult in which the history, clinical, serologic and histologic findings point to toxoplasmosis as an aquired condition with acute exacerbations requiring enucleation. Organisms resembling toxoplasma were seen in pathologic sections. The serological tests made 21 months after the acute phase appeared to be significant and confirmatory. The evidence is in favour of a chronic infection remaining latent in the ocular tissues for many years and recrudescing to give rise to an acute chorioretinitis in middle age. Sections from other cases of granulomatous uveitis occasionally showed suspicious forms but were thought to be cellular debris. (9 figures, 19 references)

Orwyn H. Ellis.

Goncalves, Danilo. **Hydatic cyst in orbit.** Rev. brasil. oftal. **12**:267-274, Dec., 1953.

The author presents a brief case history of a patient with unilateral exophthalmos, severe chemosis, impaired motility of the globe, and a hyperemic optic disc, with visual acuity reduced to hand motions. He discusses briefly the differential diagnosis from osteoma, colesteatoma, fibroma, sarcoma, or hydatid cyst. The decisive fact in the diagnosis was a strongly positive reaction of Casoni. The therapy used by the author was a Krönlein approach and evacuation of the cyst without surgical removal. After surgery the patient did well with injections of hydatid antigen over a period of six months. One year after his initial surgery, the patient had an accident and his exophthalmos recurred. He was operated upon again, and accidentally the cyst was perforated and about 15 cc. of fluid were evacuated. The wound was closed, and two days later the patient was reoperated and the cyst completely removed. A complete cure was obtained. (2 figures) Walter Mayer.

Gurling, K. J. **Association of Sjøgren's and Felty's syndromes.** Ann. Rheumat. Dis. **12**:212-216, Sept., 1953.

The association of rheumatoid arthritis, spleenomegaly, and leucopenia, with keratoconjunctivitis sicca in two elderly women is reported. Irwin E. Gaynon.

Hedges, T. R., Jr., and Rose, E. **Hyperophthalmopathic Graves' disease.** A.M.A. Arch. Ophth. **50**:479-490, Oct., 1953.

The clinical course of 19 patients with hyperophthalmopathic Graves' disease is described. The patients were followed from one and one-half to 20 years. Exophthalmos tended to become stabilized or to regress after reaching a maximum in four to 12 months. The authors do not agree that the syndrome can be divided into "thyrotropic" and "thyrotoxic" types. They believe that the syndrome should be regarded as a "clinical spectrum, ranging from simple proptosis and lid retraction to the most severely progressive forms. . . ." They propose the hypothesis of local tissue sensitivity to pituitary hormone as an explanation for the marked clinical varations in eye signs. Their therapy has included the use of stable iodine and desiccated thyroid. Pituitary irradiation was used in selected cases. Surgical decompression of the orbit is considered a measure of last resort. They believe the disease is self-limited. (3 figures, 18 references) G. S. Tyner.

Hudson, J. R. **Ocular findings in haemochromatosis.** Brit J. Ophth. **37**:242-246, April, 1953.

Retinal microaneurisms and conjunctival aneurisms were found in three-fourths of a group of cases of hemochromatosis. The changes resembled those found in diabetes which also was present in some of these patients. There are thus no ocular findings characteristic of hemochromatosis. (3 figures, 8 references) Orwyn H. Ellis.

Litricin, Olga. **Echinococcus cyst of the eyeball.** A.M.A. Arch. Ophth. **50**:506-509, Oct., 1953.

A multilocular hydatid cyst of the globe is reported. A large cyst filled the posterior segment and two smaller ones occupied a space in the choroid. The patient was a seven-year-old child. There was a dog in the house with which the child often played. (2 figures, 9 references) G. S. Tyner.

Meyerratken, E. **Eye changes in temporal arteritis and in Burger's disease.** Klin. Monatsbl. f. Augenh. **123**:433-439, 1953.

Two men, nearly 80 years old, with practically identical history and clinical findings had headache and rheumatoid arthritis. Both experienced bilateral blind-

ness with anemia of the discs. Biopsy of the temporal artery revealed in one a temporal arteritis, in the second patient a thromboangiitis obliterans. (1 figure, 29 references) Frederick C. Blodi.

Remky, H. **Retinal circulation in migraine and other conditions of acute headache.** Arch. f. Ophth. **154**:58-64, 1953.

The author used a method which has been described to study the conditions of the retinal vessels in migraine and related conditions. More than 100 patients were examined. Vascular hypotony and signs of increased permeability were found three times as often as hypertony and spasmodic signs. Disturbances of the regulator mechanism of the internal carotid circulation seem mostly limited to these two types of reaction. (3 figures, 11 references) Ernst Schmerl.

Rudd, C., Evans, P. J., and Peeney, A. L. P. **Ocular complications in thalassaemia minor.** Brit. J. Ophth. **37**:353-358, June, 1953.

Ocular complications in a case of Mediterranian anemia showing the heterozygous form of a hereditary trait which has a dominant character, under the name of thalassaemia minor, is recorded. This is a hemoblastic anemia showing many "target" cells in the red blood cells. The patient had vitreous hemorrhages and bilateral progressive detachment of the retina. Treatment was of no avail. The patient's mother had the same blood picture but was without symptoms. (4 figures, 5 references) Orwyn H. Ellis.

Toselli, C. **Clinical observations concerning the sign of Moebius.** Boll. d'ocul. **32**:651-656, Nov., 1953.

Fourteen patients with Graves' disease were studied as to the presence of convergence insufficiency. The sign was found in all of them and was not related to refraction or muscular balance. The degree of exophthalmos had no bearing on the convergence insufficiency but the disturbance of the basal metabolism seemed to have some influence. (28 references) K. W. Ascher.

19

CONGENITAL DEFORMITIES, HEREDITY

François, J., Bekaert, J., and Stefens, R. **The pathogenesis of Bardet-Biedl's syndrome.** Ann. d'ocul. **186**:665-694, Aug., 1953.

Clinical, endocrinologic and electroencephalographic studies indicate that Bardet-Biedl's syndrome is not due to a localized disturbance in the diencephalohypophyseal region, but to a diffuse congenital lesion affecting the brain as a whole. John C. Locke.

Laborne Tavares, C. **Buphthalmos in four brothers.** Rev. brasil. oftal. **12**:243-253, Dec., 1953.

The author presents four cases of buphthalmos in brothers, children of parents who are first cousins. He analyzes the problem of heredity and consanguinity and also the statistics of some of the great ophthalmological clinics and concludes that buphthalmos is a rare disease, occurring in 0.010 to 0.079 percent of all eye patients. He believes that consanguinity definitely plays a role in the appearance of buphthalmos. (5 figures) Walter Meyer.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Berrettini, G. L. **Systematization of nomenclature of excess of lacrimal secretion.** Rev. brasil. oftal. **12**:259-266, Dec., 1953.

This paper is intended for Portuguese-speaking ophthalmologists and tries to systematize the nomenclature of lacrima-

tion, epiphora, crying, and similar terms used in Portuguese. Walter Mayer.

Biernacka-Biesierska, Jadwiga. **Impairment of visual efficiency by the ocular and respiratory protective device.** Klinika Oczna **23**:91-100, 1953.

The author examined 31 types of protective devices from the point of view of impairment of visual fields. Other visual functions were less affected by the goggles or masks. 500 visual fields were taken in 95 individuals. For controls each individual had his visual field examined before the goggles or masks were worn. The most disturbing factor was the decrease in size of the binocular visual field. Protective devices are very necessary and facial shields are better than goggles. If goggles must be worn they should be of the open type, individually fitted, with lenses at least 50 mm. wide. Twelve of the 31 types of goggles examined were considered unacceptable. (7 figures, 15 references) Sylvan Brandon.

ten Doesschate, G. **The retinal perspective.** Arch. f. Ophth. **154**:79-85, 1953.

The author discusses the retinal perspective in the works of art. To get a stereoscopically correct impression of a perspective drawing, the picture should be looked at with one eye brought into the center of the perspective. Among other studies the author refers to R. Carpenter: The esthetic basis of Greek Art, 1921. (2 references)

Ernst Schmerl.

Huerkamp, B. **Ipsilateral and almost simultaneous abscess of the brows in homozygous twins.** Klin. Monatsbl. f. Augenh. **123**:489-490, 1953.

These two identical twins, 17-year-old boys, had the same infectious process near the temporal end of the right eyebrow, only three months apart. One could hardly assume hereditary predisposition. The experience is reported as a curiosity. (1 figure) Frederick C. Blodi.

Rycroft, B. W. **The corneal grafting act, 1952.** Brit. J. Ophth. **37**:349-352, June, 1953.

Since the removal of cadaver eyes for graft purposes, even with the consent of relatives, was illegal and as many enlightened people in Great Britain wished to bequeath their eyes for corneal grafts, a law was passed allowing this to be done. The text is printed in the journal.

Orwyn H. Ellis.

Schober, Herbert. **Eye complaints with vapor lamps.** Klin. Monatsbl. f. Augenh. **123**:462-474, 1953.

Many complaints after the installation of new vapor lamps are psychogenic; however, before the installation of such lamps one must consider their specific physical properties. The emission of short-waved ultraviolet rays is so small that it could not be injurious to conjunctiva or cornea. (1 chart, 26 references)

Frederick C. Blodi.

Soriano Fischer, Elisa. **Blindness in infancy.** Arch. Soc. oftal. hispano-am. **13**: 1073-1085, Sept., 1953.

A statistical analysis of causes of blindness in the School for the Blind in Madrid shows that among the 380 children, 54.59 percent of blindness was caused by congenital and hereditary factors. There was one case of retrolental fibroplasia. Ten were blind from sympathetic ophthalmia. The author urges close cooperation between the state and the church in an effort to diminish hereditary blindness. (2 tables) Ray K. Daily.

PROGRAM*

of the

ASSOCIATION FOR RESEARCH IN OPHTHALMOLOGY

Wednesday—June 23, 1954

I. Heterozygous actions of color-blindness genes. Gordon L. Walls.

II. The participation of different groups of cones in human dark adaptation. Edgar Auerbach, M.D., and George Wald, Ph.D.

III. Photography of the anterior segment of the rabbit eye. William Stone, Jr., M.D., and Leonard Reynolds.

IV. Effect of alcohol on binocular vision. G. A. Brecher, M.D., A. P. Hartman, and D. D. Leonard.

V. An experimental study of electroretinography: I. The electroretinogram in experimental animals under the influence of methanol and its oxidation products. J. Praglin, Ph.D., R. Spurney, and A. M. Potts, M.D.

VI. Studies on the visual toxicity of methanol: V. The role of acidosis in experimental methanol poisoning. A. P. Gilger, M.D., and A. M. Potts, M.D.

VII. Studies on the visual toxicity of methanol: VI. The clinical picture of methanol poisoning in monkeys treated with base. A. M. Potts, M.D.

VIII. The Liebmann effect in binocular perception. T. F. Schlaegel, Jr., M.D.

Thursday—June 24, 1954

I. Studies on the anaerobic metabolism of the lens capsule of beef. Zacharias Dische, M.D., and Gabrielle Ehrlich, Ph.D.

II. Anaerobic carbohydrate metabolism by lens extract. Harry Green, Ph.D., and Carol A. Bocher, M.S.

III. An experimental evaluation of intraocular streptokinase. James O'Rourke, M.D., and Irving H. Leopold, M.D.

IV. The cytology of external ocular disease. S. J. Kimura, M.D., and Phillips Thygeson, M.D.

V. Further studies on the nature of the exophthalmos-producing principles in pituitary extracts. George K. Smelser, M.D., and V. Ozanics.

VI. Changes in the organic phosphate fractions of the lens. John E. Harris, M.D.

VII. The transport of glucose across the lens capsule. John E. Harris, M.D.

VIII. The nonstriated muscle of the human orbit. Walter H. Fink, M.D.

Friday—June 25, 1954

I. The effects of carbonic anhydrase inhibition of the eye. Bernard Becker, M.D.

II. Study of the growth of the anterior corneal layer in relation to the plastic artificial cornea. William Stone, Jr., M.D.

III. An unsuccessful attempt to produce hypersensitivity to uveal tissue in guinea pigs. Howard A. Naquin, M.D.

IV. Electrophoretic studies of tears. W. K. McEwen, Ph.D., and S. J. Kimura, M.D.

V. Panuveitis in hamsters with chronic Toxoplasma and Besnoitia infection. J. K. Frenkel, M.D.

VI. Studies of immunity in experimental herpetic keratitis in rabbits. Ray L. Hall, M.D., Ruth G. MacKneeson, B.A., and H. L. Ormsby, M.D.

VII. Intraocular penetration of magnamycin. Hans Haussler, M.D., and H. L. Ormsby, M.D.

VIII. Effect of various media on the growth of corneal epithelium in tissue culture. Anne Fowle, Ph.D., and H. L. Ormsby, M.D.

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* Abstracts will appear in the Program Issue of the *Journal of the American Medical Association*.

PROGRAM

of the

SECTION ON OPHTHALMOLOGY

AMERICAN MEDICAL ASSOCIATION

June 22 through June 25, 1954

San Francisco, California

Tuesday Afternoon—June 22, 1954

CHAIRMAN'S ADDRESS

Trygve Gundersen, Boston, Massachusetts

CHOROIDOPATHY

Arthur J. Bedell, Albany, New York

A seemingly new clinical infiltration of the choroid was first suggested under the title "Choriodopathy" in June, 1951. Since that time other similar but not identical cases have been seen.

The disease consists of many pale, soft, yellow, widely distributed areas beneath the retinal vessels, unaccompanied by migration of pigment but showing a tendency to increase in number and size. Even after several years, central visual acuity is only slightly reduced although field changes are common. The presentation will be in the form of serial Kodachromes.

VISUAL CHANGES IN MALIGNANT EXOPHTHALMOS

Joseph Igersheimer, Boston, Massachusetts

Besides corneal exposure and ophthalmoplegia, there are occasionally visual changes in malignant exophthalmos of great concern to the patient, as well as to the ophthalmologist. In very rare cases the retina may show some pathology. Of special interest is the involvement of the optic nerve. It occurs in the form of progressive visual failure, either with normal fundus or with papilledema. It is apparently the intraorbital pressure which has a damaging effect upon the optic nerve on different parts of its orbital course. The value of X-ray radiation of the pituitary and of orbital decompression in cases with visual changes is discussed.

OCULAR PENETRATION OF PROCAINE FOLLOWING SUBCONJUNCTIVAL INJECTION

Henry E. Schlegel and Kenneth C. Swan, Portland, Oregon

In ocular surgery local anesthetics commonly are injected around the globe; however, there is a paucity of data concerning their penetration and distribution in the ocular tissues. The effects of adding vasoconstrictor drugs and hyaluronidase have not been determined with certainty. Techniques which permit determination of minute amounts of procaine in the ocular tissues have established some facts which have significant clinical applications.

THE ELECTRORETINOGRAM IN NYCTALOPIA

John C. Armington and Gerald J. Schwab, Washington, D.C.

Electroretinograms are described which were obtained from patients exhibiting various forms of night blindness. A detailed study with the electroretinograph was made of two patients with congenital nyctalopia without fundus change. These tracings exhibited only photopic components and suggested that this type of nyctalopia may exist in two forms. Detailed relative spectral sensitivities for these subjects were plotted. Patients with primary pigmentary degeneration of the retina were also studied, and all exhibited the typical subnormal or extinguished type of electroretinogram. Simple myopes with the complaints of defective night vision failed to reveal any abnormality in the electroretinogram.

ELEVATED LESIONS OF THE MACULAR AREA: A HISTOPATHOLOGIC STUDY

William C. Frayer, Philadelphia, Pennsylvania

Difficulties encountered in the differential diagnosis of a markedly elevated macular lesion in a 68-year-old man stimulated the author to review the literature and a group of histologic sections. The eye in question was enucleated with a mistaken diagnosis of malignant melanoma. Confusion regarding the etiology and pathogenesis of nonneoplastic, subretinal proliferative lesions in the macular area persists. They have been variously ascribed to hemmorrhage, inflammation, fundamental defects in Bruch's membrane, and proliferation of pigment epithelium. In 1941, Holm analyzed previously reported cases and concluded that histologic diagnosis is difficult because of the similarity of the response to various etiologic factors. Histologic study was made of the presently reported case, and of 18 cases from the files of the Armed Forces Institute of Pathology. This study led to the conclusion that the etiologic mechanism of elevated lesions of the macula is often difficult to determine by histopathologic study. The end results of hemorrhage, inflammation, and degeneration are indistinguishable in most cases.

THE USE OF RADIOACTIVE PHOSPHORUS (P_{32}) IN DIFFERENTIATING NEOPLASTIC FROM OTHER INTRAOCULAR LESIONS

I. J. Eisenberg, I. S. Terner, and Irving H. Leopold, Philadelphia, Pennsylvania

In the study on the use of P_{32} in the detection of intraocular malignancies reported at the A.M.A. last year, it was shown that one could not differentiate definitely between active inflammatory and neoplastic lesions with the technique employed. The test has been modified to include readings at one, six, 24, and 48-hour intervals. This modification has

been tried on over 100 cases of intraocular pathology due to various causes. From the results obtained new criteria have been outlined for a positive P_{32} test. These criteria have reduced the incidence of false positives. Using these new criteria one can differentiate more readily between active inflammatory and neoplastic lesions.

Wednesday Afternoon—June 23, 1954

EXECUTIVE SESSION

AN EVALUATION OF OCULAR SIGNS AND SYMPTOMS IN VERIFIED BRAIN TUMOR

James F. O'Rourke and Nathan S. Schlezinger, Philadelphia, Pennsylvania

This presentation represents a study in retrospect of 100 patients with verified brain tumor, each of whom presented first at an eye hospital for treatment. An elaboration of the five common "eye hospital tumor types" is undertaken because these types comprise over 80 percent of the series. Included in the analysis are figures on the reliability of such ocular findings as papilledema, muscle palsy, and optic atrophy. Frequency of headache, visual aberration, and positive X-ray findings are also discussed. A consideration of the survival-mortality ratio will conclude the presentation.

SOME ASPECTS OF PREPARATION, STERILIZATION, AND PRESERVATION OF OPHTHALMIC MEDICATIONS

John T. Murphy, Henry F. Allen, and Anita B. Mangiaracine, Boston, Massachusetts

Sterility of eye solutions can be realized as an absolute concept only when sterilization is carried out in the final container. The use of steam under pressure for this purpose has been heretofore considered impractical. Data are presented to show that significant degradation of many collyria does not occur when they are autoclaved under suitable conditions. Preservation of medications is contingent upon proper technique in their use and upon the presence of a suitable bacteriostatic agent in the solution. A comparative study of several such agents is reported, in respect to their effectiveness against selected common contaminants, including several strains of Pseudomonas.

ADULT OCULAR TOXOPLASMOSIS: A PRELIMINARY REPORT OF A PARASITOLOGICALLY PROVEN CASE

Leon Jacobs, Bethesda, Maryland, John R. Fair, and John H. Bickerton, Washington, D.C.

For the past several years, clinical and serologic evidence has been accumulating in support of the theory that acquired toxoplasmosis may be an important cause of uveitis in adults. Strong pathologic support of this belief was added by Wilder in 1952 when she described the finding of parasites resembling Toxoplasma in more than 50 cases of inflammatory eye disease. Proof of the identity of the organism, however, depended on the isolation of the living parasite. It is the purpose of this paper to report a parasitologically proven case of adult ocular toxoplasmosis. The details of the investigation will be described, including the serologic and pathologic findings.

PERIODIC UNILATERAL EXOPHTHALMOS: REPORT OF A CASE

James E. Bennett, Cleveland, Ohio

A case is submitted of a 45-year-old white man with rhythmic attacks of periodic unilateral exophthalmos occurring at intervals of approximately 31 days during a period of three and one-half years. The attacks were observed and documented for six months prior to beginning investigative therapy. The normal sequence of the attacks of exophthalmos was illustrated by photographs and correlated with diagnostic studies. These investigations included variation in eosinophil counts, radioactive-iodine uptake studies, minnow assays for exophthalmic factor, 17 keto-steroid excretion rates, and orbicularis muscle biopsy. Therapeutic studies were conducted with ACTH, stilbesterol, benadryl, and cortisone acetate. Cortisone controls the attacks to a varying degree which permits the patient to work at the time of an attack. An attempt has been made to correlate clinical observations, laboratory data, and therapeutic results with current experimental work on endocrine produced exophthalmos. A brief résumé of pertinent medical literature was made. Medical literature has been searched without revealing a similar case of exophthalmos.

HEREDOMACULAR DEGENERATION

Corley B. McFarland, South Bend, Indiana

Herein is described a family suffering from heredogeneration of the macula (hereditary congenital degeneration of the macula). The inheritance is a dominant genetic factor as shown by the pedigree. Included in the study is a histopathologic report which indicates an extensive defect of the first neuron layer in the region of the macula. Glial proliferation replaces the pigment layer and neuroepithelium of this region. Bruch's margin undergoes a process of fragmentation and calcareous change. The senile changes associated with sclerosis of the chorio-capillary layers are evident.

Thursday Afternoon—June 24, 1954

UNILATERAL BLINDNESS OCCURRING DURING ANESTHESIA FOR NEUROSURGICAL OPERATIONS

Robert W. Hollenhorst, Hendrik J. Svien, and Clair F. Benoit, Rochester, Minnesota

Each of the nine patients included in this report underwent surgical procedures carried out in the suboccipital or cervical region. Operation was done with the patient under the influence of intratracheal anesthesia and in the sitting or prone position, with the face supported by a headrest. On awakening from the anesthesia, each patient complained of visual loss in one eye. In some there was accompanying edema of the eyelids and proptosis. All had signs of retinal ischemia. Recovery varied from complete return of vision to permanent loss. It was concluded that these events resulted from pressure exerted on the closed eyelids by the face-rest. Fundus photographs of the course of events reproduced in the monkey are shown.

Beta-radiation cataracts

James E. McDonald, William F. Hughes, Jr., and Vincent G. Peiffer, Chicago, Illinois

Previous reports have indicated the possibility of inducing lens changes by beta radiation in humans using radon and in rabbits with radioactive Sr_{90}-Y_{90}. Because of the present availability of beta radiation therapy to many ophthalmologists using the Sr_{90}-Y_{90} applicator, the danger of postradiational cataracts should be appreciated. In rabbits, the minimal clinical cataractogenic dose applied over the limbus is 0.5 gm. sec. or less using radon, and 500 rep using Sr_{90}-Y_{90}. The minimum doses necessary to produce persistent nebular opacity of the rabbit cornea is 10 gm. sec. (radon) and 25,000 rep (Sr_{90}-Y_{90}) for these applicators. Re-examination of 74 eyes of patients whose corneas permitted detection of any lens opacities, treated with beta-radon as long as five and one-half years previously, revealed 46 who had lenticular vacuoles and opacities, largely in the equatorial region beneath the area of limbal treatment with doses as low as 4.0 gm. sec. The application of these findings in the clinical use of beta radiation will be discussed.

The surgical management of nonparalytic exotropia

Robert D. Mulberger and P. Robb McDonald, Philadelphia, Pennsylvania

The authors define the terminology employed and give a simple classification of the nonparalytic exotropias. Approximately 150 cases are reviewed and the surgical management employed is discussed. It was found that a number of surgical procedures were employed with varying results. The authors believe that already established techniques will give more uniform results and that there is no justifiable reason for numerous surgical procedures for the same muscular imbalance. The end results of these cases are tabulated and the authors' opinions are given as to the desirability of certain types of surgical procedures to be employed in these cases.

Divergence insufficiency

Donald J. Lyle, Cincinnati, Ohio

The subjective symptom of divergence insufficiency is sudden appearance of double vision for distance. Single vision remains for close. The cause of diplopia is not obvious upon inspection and requires examination of all types of muscle action. Usual tests reveal what appears to be moderate homonymous concomitant heterophoria but because of disturbance of innervation, double vision is present. The condition in reality is manifest heterotropia. Versions, with minor reservations, are essentially normal. Ductions and convergence are normal. Divergence is absent or greatly reduced. This condition is usually the result of varied pathologic conditions involving the brain, particularly the midbrain and pons. Cases of divergence insufficiency are abstracted. Prognosis depends upon etiology. Ophthalmologic treatment consists of prisms or occlusion of one eye. Surgery of lateral recti muscles may be resorted to if diplopia persists.

Lymphomatous tumors: A clinical follow-up

John S. McGavic, Bryn Mawr, Pennsylvania

This paper is a report of the follow-up of 20 of 21 patients with lymphomatous tumors involving the eye and its adnexa. Sixteen of the patients were alive at the time of the first report at the Section on Ophthalmology of the American Medical Association in 1942. One patient with a solitary lymphoma of the iris has been lost to follow-up. Five of the remaining 20 are now living, one with disease, and four free from disease. Five of the patients died of conditions other than lymphoma. The cell type is important in regard to survival. The average survival rate was 10.25 years. Seven patients whose tumors remained localized up to 1953 or until death from other causes survived an average of 16 years. The 15-year follow-up is unusually long and indicates that the prognosis is somewhat better than generally believed. The literature regarding incidences, survival rates, and treatment has been brought up-to-date.

Lipochondrodysplasia (gargoylism)

Frank W. Newell and Douglas N. Buchanan, Chicago, Illinois; Aune Koistinen, Helsinki, Finland

A number of patients presenting many of the signs of lipochondrodysplasia have been seen at the University of Chicago Clinics. Among these patients three died in the hospital and the eyes were obtained for microscopic study at autopsy. It is the purpose of this paper to correlate pathologic changes of the eyes with similar changes in other organs and to review briefly the history, symptomatology and differential diagnosis of the condition.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month. To receive adequate publicity, however, notices of postgraduate courses and meetings should be received at last three months before the date of occurrence.

DEATHS

Dr. Paul Jacob Stueber, Lima, Ohio, died December 22, 1953, aged 67 years.

Dr. Fred Sanborn Thorne, Boston, Massachusetts, died December 6, 1953, aged 63 years.

Dr. Walter Franz von Zelinski, Santa Barbara, California, died December 26, 1953, aged 71 years.

MISCELLANEOUS

THE EDWARD L. HOLMES AWARD

Of interest to ophthalmologists is the recent announcement of an annual award to be presented for significant contributions to medical science with preference to be given for advances in ophthalmology, especially those made by investigators under 35 years of age. The amount available approximates $500 per year and represents the income on a trust fund set up under the will of the late Dr. Rudolph Holmes, prominent Chicago obstetrician and gynecologist, in memory of his father, Dr. Edward Lorenzo Holmes. The administration of the fund and selection of the annual recipient is vested in the Institute of Medicine of Chicago.

Dr. Edward L. Holmes was the pioneer Chicago ophthalmologist who practiced there from 1858 to 1900. He is credited with founding the Illinois Charitable Eye and Ear Infirmary, was one of the founders of the Presbyterian Hospital of Chicago, and a member of the faculty of Rush Medical College from 1860 to 1898, serving as professor of ophthalmology from 1867 to 1898 and as president of the college from 1890 to 1898. He was the first president of the Chicago Ophthalmological Society when it was organized in 1892.

On recommendation of a special committee of Chicago ophthalmologists the Board of Governors of the Institute of Medicine honored Dr. Arnall Patz of Baltimore, Maryland, with the first Edward L. Holmes Citation and Award for his work in retrolental fibroplasia. At a joint meeting of the Institute with the Chicago Ophthalmological Society on March 1, 1954, the Holmes Memorial Lecture on "Oxygen studies in retrolental fibroplasia" was presented by Dr. Leroy Hoeck in the absence of Dr. Patz who was unable to attend due to illness.

PITTSBURGH RESEARCH LABORATORY

A biophysical research laboratory for fundamental studies has been established at the Eye and Ear Hospital, University of Pittsburgh Medical Center through the Eye Bank of Pittsburgh and the McClintic Endowment. This new laboratory for the exploration of visible radiation, as related to the visual processes, is the only one in, and a unique addition to, the University of Pittsburgh Medical Center. It will closely collaborate with the Department in the School of Medicine as well as the University Departments of Physics, Biophysics, and Biochemistry.

Dr. Jerome J. Wolken has been appointed director and head of this new research laboratory.

ANNOUNCEMENTS

RESIDENT OPENINGS

The Boston City Hospital has openings for residents in ophthalmology. Appointments for 15 months are available October 1st, January 1st, April 1st, and July 1st. A basic science course is required. For further information write to: Staff Secretary, Boston City Hospital, Boston, Massachusetts.

TWO-YEAR RESIDENCY AVAILABLE

The Jewish Hospital of Brooklyn has an opening for a two-year residency in ophthalmology beginning July 1st. Applicants are requested to communicate with Sydney C. Peimer, assistant director, The Jewish Hospital of Brooklyn, 555 Prospect Place, Brooklyn 38, New York.

TEXAS RESIDENCIES

Residencies in ophthalmology will be available July 1, 1954, at the University of Texas, Medical Branch Hospitals, Galveston, Texas. A new nine-story addition to the hospital has just been opened; 26 beds are allocated for eye. There is a large outpatient service. Good opportunity is offered for clinical, surgical, and research training in approved residencies. Training in basic ophthalmology is required. For further information write Dr. Gaynelle Robertson, acting chairman, Department of Ophthalmology, University of Texas Medical Branch, Galveston, Texas.

COURSE ON GLAUCOMA

A course on glaucoma with particular emphasis on gonioscopy and study of the anterior angle will be given at the Brooklyn Eye and Ear Hospital on May 17, 18, and 19, 1954. Ample opportunity for practical instruction in the use of the goniolens will be given and material from the glaucoma clinic will be utilized.

The course will be given by Dr. Daniel Kravitz, assisted by Dr. Walter V. Moore, Dr. Mortimer A. Lasky, Dr. Harold F. Schilback, and Dr. Arthur Shainhouse.

Registration is limited to six ophthalmologists only. Application and the fee of $40.00 may be addressed to Dr. Daniel Kravitz, Brooklyn Eye and Ear Hospital, 29 Greene Avenue, Brooklyn 38, New York.

Home-Study courses

The Home-Study courses in the basic sciences related to ophthalmology and otolaryngology, offered as a part of the educational program of the American Academy of Ophthalmology and Otolaryngology, will begin on September 1, 1954, and continue for a period of 10 months. Registrations must be completed before August 15. Detailed information and application forms may be obtained from Dr. William L. Benedict, the executive secretary-treasurer of the Academy, 100 First Avenue Building, Rochester, Minnesota.

Societies

Brooklyn meeting

At the 127th regular meeting of the Brooklyn Ophthalmological Society, Dr. Edward W. C. Norton presented a paper on "Neurologic disorders of ocular motility," which was discussed by Dr. John M. McLean and Dr. Harold R. Merwarth.

United Kingdom congress

At the annual congress of the Ophthalmological Society of the United Kingdom, held at the University of Durham, Newcastle-on-Tyne, England, April 22 through 24, the subject for discussion was "Inflammatory vascular diseases affecting the eyes." Three short symposiums were held on "Changes in the incidence of the eye affections of coal miners in the past 25 years," "Gonioscopy," and "Cyclodiathermy."

Savannah meeting

Dr. Alston Callahan, Birmingham, presented a movie on "The reconstruction of canaliculi after trauma and disease," at the annual meeting of the Georgia Society of Ophthalmology and Otolaryngology held at the General Oglethorpe Hotel, Wilmington Island, Savannah, Georgia. Guest lecturers in ophthalmology were: Dr. Paul A. Chandler, Boston, "Complications of cataract extraction"; Dr. Algernon B. Reese, New York, "Causes and treatment of defective vision in children"; Dr. Henry P. Wagener, Rochester, Minnesota, "Types or retinal arterial occlusion: Their diagnosis and treatment."

Personals

Ophthalmologists will be proud to know that the promotion of Dr. Harold G. Scheie to Brigadier General (MC:USAR) was approved by the Senate on January 26, 1954. He was originally commissioned as a first lieutenant in the Medical Reserve Corps in February, 1936. He served four years of active duty during World War II, two and a half years of which were spent in the China-Burma-India Theater and one year at the Crile General Hospital. While on foreign duty, he was ophthalmologist to the 20th General Hospital, an affiliated unit from the University of Pennsylvania Medical School, and was decorated with the Order of the British Empire (Military) by the British Government for his work with British troops. He maintained his active affiliation with the Medical Reserve Program following the war and has been commanding officer of the Headquarters, 31st Hospital Center, since June 5, 1951.

After World War I, William Wilmer and George de Schweinitz became reserve brigadier generals. Dr. Scheie is the first and only ophthalmologist to obtain this distinction after World War II, and it is good to know that we have such an able ophthalmologist to represent us at court.

Mrs. Helenor Campbell Wilder, who recently retired from her duties as chief of the Section of Ophthalmic Pathology at the Armed Forces Institute of Pathology, has a long list of achievements which have gained for her international recognition as an ophthalmic pathologist. On May 2, 1953, she was honored by the Women's National Press Club as the "Woman of the Year." The first woman to be elected to honorary membership in the American Academy of Ophthalmology and Otolaryngology, she has lectured from Baltimore to Tokyo.

At a farewell dinner in the Officers' Club of the Walter Reed Army Medical Center, Mrs. Wilder was honored for her more than 33 years of service at the Armed Forces Institute of Pathology. Brigadier General Elbert DeCoursey, director of the institute, has stated that her work has advanced the study of the eyes more than 50 years

Mrs. Wilder, who was recently married to Mr. Roland C. Foerster, will make her new home in San Francisco, California.

Dr. Milton L. Berliner, New York, has been elected an honorary member of the Greece Ophthalmological Society in recognition of his contributions to ophthalmology.

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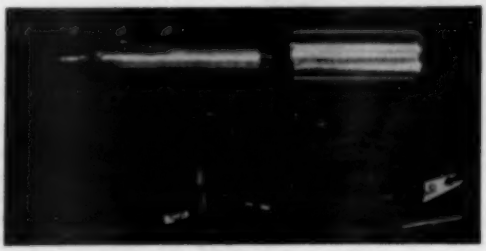

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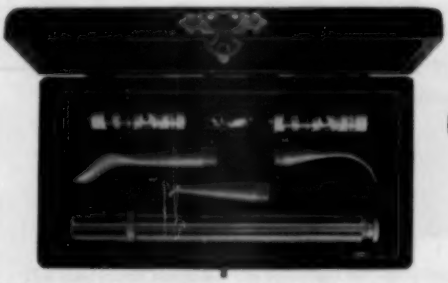

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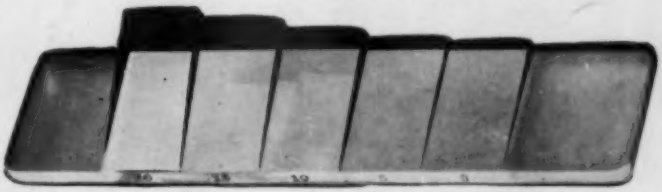

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